



Tile Til Eo
2050 CLIMATE STRATEGY
“Lighting the way”

The Republic of the Marshall Islands

September 2018

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Dedication

Ilo Ememej Minister Mattlan Zackhras ilo ettonak eo
an nan eiki monakjen in jibadbad kein iumin Strategy 2050.

Dedicated to the memory of Minister Mattlan Zackhras
and his vision to produce this 2050 Strategy.

Foreword

As seafaring people we know that a long journey requires careful navigation. In beginning to ask ourselves what kind of country we want to live in by the middle of this century, our 2050 Climate Strategy provides us with a compass that we can use to travel with confidence and along a steady course. And by ensuring that it is a dynamic, living document, we will improve the Strategy over time, allowing us to carry out our journey with increasing precision as we get closer to our destination.

Under the Paris Agreement that my country was proud to have played a key role in helping secure, every country should strive to formulate and communicate long-term low greenhouse gas emission development strategies, and to do so by 2020. These “2050 Strategies” will be essential for each country to set a clear direction of travel and provide a domestic context in which to progressively raise ambition in a manner that is consistent with achieving the goals of the Paris Agreement. Quite simply, the five-year cycles of the Paris Agreement will only ever yield the necessary increases in climate ambition if coupled with each country setting a long-term vision that it works towards achieving.

In producing our own 2050 Strategy, we wanted to set a clear framework for progressing towards net zero greenhouse gas emissions by 2050, as well as transitioning to an economy and society that is resilient and can adapt to the inevitable impacts of climate change. But most importantly, we wanted to do this in a way that promotes sustainable development and the future well-being of the Marshallese people – women, men and youth. The process of producing our 2050 Strategy has of itself been a useful experience.

In my experience long journeys require many partners. We therefore invite everyone to consider how they may be able to support the Marshall Islands in our own journey, but also ask those countries that have not yet produced their own 2050 Strategies to start that process and discover for themselves the possibilities and opportunities they can reveal.



H.E. Dr. Hilda C. Heine
President



The Honorable David Paul
Minister-in-Assistance to the President & Environment Minister
Chair of the *Tile Til Eo* Committee

The Marshall Islands – a Context

1. The Republic of the Marshall Islands (**RMI**) is one of the world's lowest-lying and climate vulnerable countries. It is a coral atoll nation comprising 1,156 individual islands/islets and 29 different atolls with an average elevation of just six feet above sea level, dispersed across nearly two million square kilometers of the Pacific Ocean. The national population is almost 53,000 and the national Gross Domestic Product (**GDP**) is approximately US\$180 million, driven overwhelmingly by external assistance from the Compact of Free Association relationship with the United States and remittances. National industry and agriculture, including fisheries and especially tuna, account for less than 15% of economic activity.
2. Gaining independence in 1986, after a long period of contestation and occupation, RMI is now a stable and peaceful democracy. However, the impacts of 67 different nuclear tests are still felt. These tests, conducted by the US in the period following World War II when RMI was a UN Trusteeship Territory, were roughly equivalent in energy terms to 1.6 Hiroshima detonations every day for 12 years.
3. While RMI may only contribute 0.00001% of global greenhouse gas (**GHG**) emissions, the country has a proud history of prominent climate leadership, both at home and on the world stage. Following a global fuel price spike in 2008, RMI declared a National Economic Emergency and has since then rapidly embraced renewable energy technologies and taken huge strides in energy efficiency. For example, more than 90% of the country's outer islands have now been completely solarized. The country is also embarking on a major solar project for Ebeye (one of two major urban centers) on Kwajalein Atoll, and four other atolls. Additional stability improvements in the electricity grid are still required to allow further penetration of renewable energy in urban areas.
4. On the international stage, RMI spearheaded the 2013 Majuro Declaration for Climate Leadership, which sought to demonstrate the Pacific's adoption of some of the world's most ambitious GHG emissions reduction targets. In 2015 it played a key role in securing the Paris Agreement on climate change, including as the founder of the High Ambition Coalition (**HAC**) which it continues to convene. RMI assumed Presidency of the Climate Vulnerable Forum (**CVF**) in August 2018.
5. RMI is at the front of the front line in the battle against climate change, and its front line is its last line of defense. As one of the countries most vulnerable to climate change, adapting to climate impacts is an increasingly pressing national priority, including with respect to women, men and children in rural communities who have limited access to resources and services and so are particularly vulnerable.
6. The country is experiencing increasingly damaging effects from climate change and seeing more frequent and intense events, such as drought, floods and swells, and tropical cyclones and storms. RMI declared a State of Disaster in 2013 and 2016 as a result of prolonged and unseasonal droughts. The Post Disaster Needs Assessment (**PDNA**) from the 2016 drought estimated the total economic losses to be approximately US\$4.9 million, with agriculture being the single most affected

sector. In 2015, Typhoon Nangka cost RMI more than 3% of its GDP in a single night. As king tides become more frequent and intense, salt water is increasingly seeping into fresh water lenses, creating urgent challenges for the islands. Raising support to assist with adaptation efforts remains a significant challenge.

7. RMI has matched its international leadership in calling for greater ambition with equally ambitious domestic action. In 2015 RMI became the first Small Island Developing State (*SIDS*) to table its post-2020 Nationally Determined Contribution (*NDC*). This committed the country to a 32% reduction of GHG emissions by 2025, based on 2010 levels. It also made an indicative commitment to reduce GHG emissions by 45% by 2030, based on 2010 levels, thereby setting a projected straight-line intended NDC trajectory to achieve RMI's stated aspiration of net zero GHG emissions by 2050. The NDC was ground breaking in that it contained the first economy-wide absolute GHG emissions reduction target against a base year by a developing country.
8. In 2016 RMI also committed, under the Marrakech Partnership, to achieving 100% renewable energy by 2050. RMI has reiterated its aspiration to achieve net zero GHG emissions by 2050, including most recently through signing the Declaration of the Carbon Neutrality Coalition at the One Planet Summit in December 2017.
9. **The purpose of this 2050 Climate Strategy – which is RMI's long-term low greenhouse gas emission climate-resilient development strategy under the Paris Agreement - is to outline a long-term pathway for RMI to achieve its objectives for net zero emissions and 100% renewable energy, as well as to facilitate adaptation and climate resilience in a way that ensures the future protection and prosperity of the country and its women, men and youth.**

Section 1 – Executive Summary

Key Recommendations

In order to achieve its objectives for net zero emissions by 2050 and 100% renewable energy, as well as to adapt to the impacts of climate change and achieve resilience in a way that ensures future protection and prosperity of RMI, this 2050 Strategy makes the following recommendations:

- **Submit, by 2020 at the latest, a new NDC** in which, in the context of the necessary means of implementation being available, RMI:
 - revises its quantified economy-wide target to reduce its emissions of GHGs to at least 32% below 2010 levels by 2025;
 - commits to a quantified economy-wide target to reduce its emissions of GHGs to at least 45% below 2010 levels by 2030;
 - communicates an indicative target to reduce its emissions of GHGs by at least 58% below 2010 levels by 2035;
 - reaffirms its aspiration to achieve net zero GHG emissions by 2050 at the latest,
 - commits to producing a National Adaptation Plan by the end of 2019 at the latest that sets out short, medium and long-term milestones to adapt to the impacts of climate change and transition to climate resilience, suggests implementation measures and includes a plan to generate the necessary financing;
 - commits to submitting an Adaptation Communication to the UNFCCC by 2020 at the latest;
 - commits to a gender-responsive and human rights-based approach in all NDC-related planning, programming and implementation; and
 - commits to using the latest Intergovernmental Panel on Climate Change (*IPCC*) Guidelines (currently 2006).
- **Focus** in the short and medium term on RMI's electricity sector to implement GHG reductions consistent with achieving its NDC targets;
- **Act** to reduce RMI's growing waste problem by minimizing organic material in collected waste and consider possibilities to generate energy

from waste;

- **Develop** policies to encourage a greater use of public transport, cycling and walking, and the increased uptake of electric vehicles;
- **Explore** options to reduce GHG emissions from domestic ocean-based transport, including improved regulatory control;
- **Continue** efforts to phase out the use of kerosene for lighting and strengthen existing institutional arrangements to reduce GHGs from cooking and lighting;
- **Establish** a long-term finance strategy to implement this 2050 Strategy and its recommendations; and **identify and consider options** for a more coordinated and centralized approach to applying for, and monitor, related overseas aid and investment;
- **Ensure due diligence** is fulfilled before making significant investments to implement this 2050 Strategy and its recommendations;
- **Prioritize** capacity building in all areas relevant for the implementation of this 2050 Strategy and its recommendations;
- **Mainstream gender and human rights**, including in relation to developing, adopting, reviewing and implementing laws, policies and projects related to climate change, and commission further analysis with a view to putting in place a strategy to improve related data collection, monitoring and evaluation;
- **Include** health considerations as part of RMI's forthcoming National Adaptation Plan;
- **Include** education, training & public awareness considerations as part of RMI's forthcoming National Adaptation Plan;
- **Review and update**, as necessary, this 2050 Strategy as a minimum every five years – including to recommend targets for inclusion in future NDCs – at least one year before RMI submits future NDCs; and
- **Establish** a domestic process to oversee reviews and updates to this 2050 Strategy, as well as to monitor its implementation.

Greenhouse Gas Emissions

1. RMI's GHG emissions – as presented in the Second National Communication¹ (August 2015) – can be broken down into four key sectors: electricity; transportation (land and sea); waste; and cooking & lighting.
2. The following sections will outline illustrative decarbonization scenarios and pathways for each individual sector and, where appropriate, suggest specific considerations for RMI's major population centers (Majuro, Ebeye, Wotje, Jaluit, and Kili) and the outer islands.
3. RMI produced its NDC in 2015. The key GHG provisions of the NDC state that:
 - RMI commits to a quantified economy-wide target to reduce its emissions of GHGs to **32% below 2010 levels by 2025**;
 - RMI communicates, as an indicative target, its intention to reduce its emissions of GHGs to **45% below 2010 levels by 2030**;
 - These targets put RMI on a trajectory to nearly halve GHG emissions between 2010 and 2030, with a view to achieving net zero GHG emissions by 2050, or earlier if possible.
4. Essentially this represents a straight-line intended trajectory from the current 2025 target to zero GHG emissions in 2050 (see NDC trajectory in Figure 1 below).

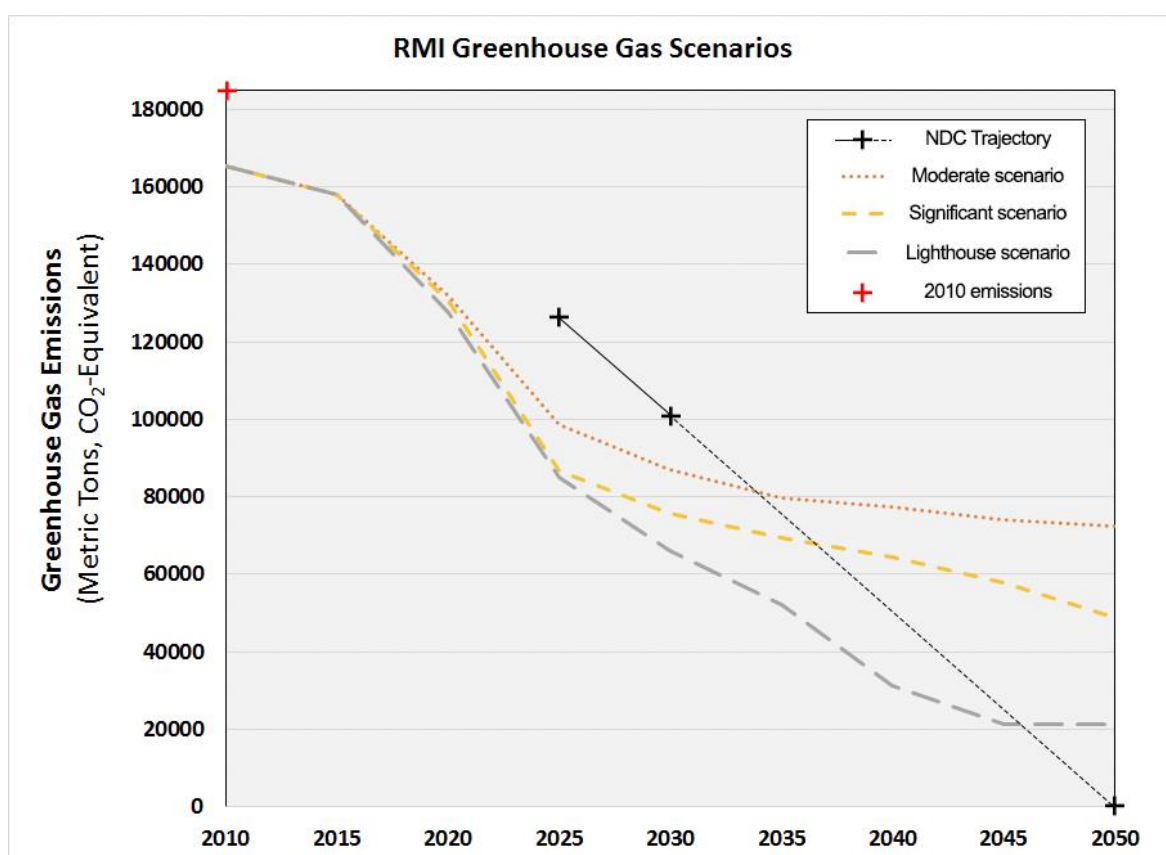


Figure 1: RMI Greenhouse Gas Emissions Reductions – NDC Trajectory and Scenarios

¹ <http://www.un-gsp.org/sites/default/files/documents/mhInc2.pdf>

5. RMI's current NDC targets are highly ambitious and will require significant additional efforts, as well as additional means of implementation, to achieve. Nevertheless, **this 2050 Strategy proposes targets for a new and more ambitious NDC** consistent with the straight-line intended emissions reduction trajectory from the 2025 target to net zero in 2050 (see below).
6. RMI has been clear – as reflected in its 2015 NDC – that its GHG targets represent a floor, and not a ceiling, to ambition. In that context, and in order to illustrate examples of how RMI might further raise ambition and to do so more quickly, **this 2050 Strategy also includes three illustrative Scenarios for RMI's GHG emissions:**
 - a "Moderate" enhanced ambition Scenario, reflecting technically and economically feasible targets;
 - an intermediate "Significant" enhanced ambition Scenario, which is equivalent to the Lighthouse Scenario, but is delayed by 15 years due to presumed lack of funding; and
 - a "Lighthouse" enhanced ambition Scenario, which is technically feasible but more expensive.
7. Each of the illustrative Scenarios (see Figure 1) is defined in more detail in the Section 2 of this 2050 Strategy. The purpose of these Scenarios is to:
 - provide illustrative examples of the range of options available, and the kind of measures that might need to be implemented to achieve them, as well as to suggest next steps;
 - provoke discussions as to what might be the best way forward for RMI to contribute to achieving the temperature goals of the Paris Agreement;
 - facilitate making progress towards achieving RMI's aspiration of net zero GHG emissions by 2050.
8. This 2050 Strategy is intended to provide a framework under which more detailed implementation plans, strategies and projects can be developed. In that context it is important, when considering measures and next steps to implement this 2050 Strategy, that reference is also made to RMI's forthcoming NDC Partnership Plan, and to keep in mind that for the electricity sector specific implementation measures will be set out in RMI's forthcoming Electricity Roadmap.

Main Points

9. Achieving RMI's 2025 NDC target and indicative 2030 NDC target is possible under the assumptions outlined in this 2050 Strategy. In both the Lighthouse and the Significant Scenarios, RMI would essentially meet its indicative 2030 NDC goal. RMI *could* achieve up to an 87% reduction in GHG emissions in the Lighthouse Scenario by 2050, without using any offsets. A pathway to eliminate remaining emissions and achieve 100% reductions by 2050 is not clear due to currently unavoidable GHG emissions from waste. But in future planning efforts, RMI can evaluate additional new technology options, carbon sinks, or offsets.

10. On the basis of the current NDC, and consistent with the straight-line intended emissions reductions trajectory from the 2025 target to net zero in 2050, as well as the content and underpinning analysis of this 2050 Strategy, **it is recommended that** – in accordance with the legally binding requirement of the Paris Agreement – RMI submits by March 2020, at the latest, a new NDC in which it:
 - **revises** its quantified economy-wide target to reduce its emissions of GHGs by 2025 to be at least 32% below 2010 levels. Changing its current 2025 target to an “at least” target is consistent with RMI’s wish to overachieve on its 2025 target, and to further raise ambition and do so more quickly, should the means of implementation to do so be available;
 - **commits** to a quantified economy-wide target to reduce its emissions of GHGs to at least 45% below 2010 levels by 2030. In doing this, RMI will make trying to achieve its previously indicative 2030 target binding under the Paris Agreement;
 - **communicates**, as an indicative target, its intention to reduce its emissions of GHGs by at least 58% below 2010 levels by 2035. This indicative target would be consistent with RMI’s straight-line intended NDC emissions reduction trajectory from the 2025 target to net zero in 2050, and so represents consistent momentum in RMI’s GHG emissions reductions efforts.
11. By specifying that targets in its future NDC will be “at least” targets, RMI will send a clear signal of intent to try to overachieve against them, and that they are a floor for ambition, not a ceiling. Nevertheless, it must be emphasized that achieving even RMI’s existing ambitious NDC targets will require the necessary means of implementation to be available. Going beyond these and overachieving against targets will clearly require the availability of further means of implementation. At the same time, the transition to renewable energy could present net future cost savings from reduced imports of fossil fuels and bring other co-benefits, for example.
12. It is worth pointing out that RMI has already undertaken significant steps to reduce its GHG emissions. Its emissions peaked in 2009, and the National Energy Policy and Energy Action Plan identifies a comprehensive list of strategies to further reduce GHG emissions. To maintain this momentum, **this 2050 Strategy recommends undertaking studies and pilot projects, which focus on the actions with the highest potential to transform RMI’s energy usage and accelerate the shift away from emissions-intensive practices**, towards net zero emissions by 2050.
13. With strategic and adaptive management, RMI can achieve significant emissions reductions and solidify its climate leadership position. In its 2009 and 2016 National Energy Plans, RMI outlined national goals for energy use that move the country toward achievement of its 100% decarbonization vision by 2050. The electricity sector has by far the greatest potential to rapidly reduce RMI’s GHG emissions in line with its 2025 and 2030 NDC targets. **The pathway to a**

sustainable green energy mix and to further decarbonizing the electricity generation sector will be set out in RMI’s forthcoming Electricity Roadmap.

Further Detail

14. This 2050 Strategy shows that by 2050, RMI can nearly achieve its goal of reaching zero emissions. In order to achieve these results without the use of GHG offsets, significant changes to energy policy and in-use technologies are needed.
15. A comparison of the NDC to the three illustrative Scenarios in 2030 and 2050 shows the following projection on 2010 levels:

	2030	2050
NDC	45% reduction	100% reduction
Moderate Scenario	47% reduction	56% reduction
Significant Scenario	54% reduction	70% reduction
Lighthouse Scenario	60% reduction	87% reduction

16. **Among the three Scenarios, the Lighthouse Scenario gets RMI closest to its stated aim of net zero GHG emissions by 2050** (see Figure 4).
17. After 2025, the three Scenarios diverge significantly in terms of achieved emissions reductions. This means that **if ambitious action is delayed, emissions reductions would need to be more aggressive in the future in order to achieve net zero emissions by 2050**. Internationally it is generally accepted that delayed action would ultimately incur greater overall costs – although this would need further analysis, taking into account the specific circumstances of RMI.
18. Decisions regarding how a Lighthouse ambition reduction strategy could be pursued will depend on a number of factors including:
 - current and projected future technology costs (e.g. energy storage);
 - the relatively higher costs of delaying action and still achieving net zero emissions reductions by 2050;
 - RMI’s international leadership on climate change; and
 - access to financing and other means of implementation.
19. In the Lighthouse Scenario, the addition of energy storage allows renewable penetration to reach 100% of electricity generation. Electric vehicles would tend to eliminate land transportation emissions, and electricity for cooking substitutions would tend to eliminate “other” emissions.

20. While waste emissions can be reduced through recycling and landfill improvements, they cannot be eliminated entirely due to the limitations of current technologies and policy options. Therefore, even under a Lighthouse emissions reductions Scenario, reaching net zero emissions by 2050 is currently not feasible. Offsetting residual emissions from waste could be considered, and more sustainable technologies may, of course, emerge in the future.

Adaptation & Climate Resilience

21. As one of the world's most climate vulnerable nations, adaptation will be a constant requirement for RMI, even if the Paris Agreement's goal of limiting global temperature increases to no more than 1.5°C is achieved. It is difficult to predict exactly what adaptation needs there will be based on how high the temperature might rise and therefore it is important to apply the precautionary principle in planning.
22. RMI has historically developed adaptation policies based on immediate and foreseen requirements, hence there is an urgent need to review and consolidate policies and measures on adaptation and climate resilience. A systematic and integrated approach that combines climate and disaster risk considerations is needed to build resilience across the entire country and economy. This should happen around three pillars:
- a clear sense of strategic principals and priorities;
 - an understanding of current and future climate change risks and impacts;
 - a phased and adaptive approach to action.
23. In that light, **RMI should start, as soon as possible, the process to develop a National Adaptation Plan (NAP)** and complete it by the end of 2019 at the latest.
24. The NAP should:
- incorporate adaptation and climate resilience milestones to be achieved, for example by 2020, 2025, 2030 and 2050, as well as suggest measures to achieve them;
 - elaborate in detail immediate, accelerated gender-responsive actions and investments over the next five years (2019-2023) to adapt to the impacts of climate change and transition to climate resilience;
 - suggest, as appropriate, updates to relevant national policies and legislation;
 - set out a plan for significant investments in adaptation and resilience in order to be in a position to fully implement its recommendations; and

- incorporate, as appropriate, the key recommendations arising from the review of the Joint National Action Plan on climate change adaptation and disaster risk management (*JNAP*).
- 25. The NAP should set out in detail RMI’s policy for domestic planning purposes. On the international front, **RMI should submit an Adaptation Communication, based on the NAP, to the UNFCCC by 2020 at the latest.** That Communication should concisely set out RMI’s contribution towards meeting the adaptation goal set out in the Paris Agreement, and the required means of implementation to fully implement that contribution.
- 26. **Both the commitment to produce the NAP and subsequent Adaptation Communication should be set out in RMI’s forthcoming NDC.**
- 27. A significant barrier to implementing RMI’s current and future adaptation and resilience measures is long-term predictable and adequate financing. Because private sector finance is particularly hard to secure in this area, public sector funding from the international climate donor and development sector must be the focus.

Means of Implementation

- 28. In order to more effectively attract investment in relation to implementing RMI’s NDC, its future NAP as well other aspects of this 2050 Strategy, **a long-term climate finance strategy needs to be put in place.** That long-term finance strategy will need to help prioritize and target funding applications in a strategic and coordinated way, and it should be regularly reviewed and monitored to deliver against key objectives.
- 29. Unless more effective oversight and coordination is put in place, including establishing a clear mechanism to enable and improve the efficiency of Overseas Development Assistance (*ODA*) coordination, RMI’s ability to attract necessary levels of future climate finance consistent with domestic priorities is likely to be significantly constrained. It is therefore recommended that the Government urgently considers how to deliver a **more coordinated and centralized approach to applying for, and monitoring, overseas aid and investment.**
- 30. At the same time, means of implementation for short term action in line with the priorities of this 2050 Strategy is also critical. Implementation of RMI’s NDC Partnership Plan, which identifies the immediate priorities for action and existing gaps, and coordinates support from partners to achieve these priorities, will be very important. This can and should be leveraged over time to enhance donor support toward implementation of future NDCs and this 2050 Strategy.
- 31. In general terms capacity and resource constraints are a significant factor restricting RMI’s ability to access international climate-related assistance. This is an issue that needs to be urgently addressed and in-country capacity building and institutional strengthening should be prioritized in this area.

Transparency, Environmental & Social Information

32. Good quality data and information management and monitoring systems are crucial for informed policy development and to measure progress towards achieving goals, and to enable results-oriented policy, investment and development planning. Lack of reliable, high quality and accessible data will, unless addressed, be a very significant barrier to RMI achieving its climate change objectives as set out in its NDC and this 2050 Strategy. This is a consistently recurring issue in relation to every aspect and sector addressed by this 2050 Strategy.
33. In that context it should be noted that some of the analysis and recommendations in this 2050 Strategy are based on RMI's GHG inventory as set out in its Second National Communication. That inventory should be officially updated and set out in RMI's future Third National Communication. The 2050 Strategy and its recommendations can be accordingly revised in future to reflect the updated emissions inventory.
34. Therefore, institutional arrangements and the roles and responsibilities for data collection, management, monitoring, analysis and dissemination should be reviewed and policies put in place to ensure that a more effective system is implemented. RMI should aspire to using the latest IPCC Guidelines where relevant.
35. Capacity building in this area should be a priority, and international funding and technical assistance already available or set aside for this purpose should be accessed, and further assistance sought as needed.
36. RMI should also prioritize producing and submitting its Biennial Update Report and its Third National Communication, and should aim to do so at the latest by the end of 2019.

Gender and Human Rights

37. Social considerations — including the differentiated impacts of climate change and the response initiatives on women, men and youth — should be systematically integrated into all climate change policy, planning and implementation. Women are disproportionately affected by the impacts of climate change due to their marginalized status in global society which limits their access, use and control over resources and services.
38. This 2050 Strategy finds there to be a need to mainstream gender considerations and a human rights-based approach in all aspects of RMI's policy and legislative development, adoption and implementation in relation to climate change. An initial step is to increase gender-differentiated and disaggregated data collection to identify gaps, needs and opportunities for women, men, youth and marginalized and vulnerable groups to address gender and social inequities,

particularly in rural remote communities. Further expert input should be sought to further improve these aspects – including in future revisions of this 2050 Strategy. A strategy should be developed to progressively ensure RMI’s full compliance with its human rights obligations.

39. Women, men, and youth should be included and engaged as valuable stakeholders in identifying and addressing the climate change concerns of their communities and to share knowledge for responses to ensure their strengthened resilience. Further support should also be commissioned from gender organizations in RMI, as well as gender and human rights experts in advocacy, engagement and capacity building, and for enhancing sector-specific gender considerations.

Approach and Future Perspectives

40. In producing this 2050 Strategy, stakeholders were of the view that existing RMI legislation, measures and policies should be built upon, and that inefficient duplication and replication should be avoided. Stakeholders also expressed a strong view that it should not be a one-off document but improved over time.
41. A key recommendation is that **this 2050 Strategy is reviewed and updated, as necessary, every five years** as a minimum, including to identify new and relevant technologies and policy options. More immediately, once the key outcomes and recommendations from the 2nd National Climate Dialogue and the Partnership Dialogue held in July 2018, have been identified, they should be collected and used in the implementation of this 2050 Strategy as well as to inform future updates. Additional comments received in the future from stakeholders of all levels should be similarly collected and used. In that sense the 2050 Strategy should be treated as a **living document**. As such, it will be critical that the key findings of this 2050 Strategy are disseminated and feedback sought from a range of stakeholders.
42. Furthermore, **updates to the 2050 Strategy should recommend the targets for future RMI NDCs one year in advance of their submission to the UNFCCC** in line with the requirements of the Paris Agreement. The recommendation process should include stakeholder consultation.
43. The *Tile Til Eo* Committee (**TTE Committee**) was established to facilitate the production of this 2050 Strategy and it has proved valuable outside of the 2050 Strategy remit as well. The Committee and this 2050 Strategy were given the name *Tile Til Eo*, meaning 'lighting the way' in Marshallese, to signify both the pathway to the country's zero emissions future and also the example which RMI hopes others can follow.
44. Consideration should be given to maintaining the TTE Committee. In any event, the TTE Committee or another body should have a future role in:
 - monitoring the alignment and consistency of relevant legislation, policies and measures with the 2050 Strategy;

- overseeing the update of the 2050 Strategy every five years – including the goals it contains;
 - monitoring progress towards achievement of RMI’s current NDC; and
 - recommending the targets and goals of future RMI NDCs.
45. It is strongly recommended that the TTE Committee or other body should be as independent of day-to-day Government decision-making as possible, so as to enhance the credibility of its functions and to maximize the possibility of considering and advising on politically sensitive issues in making future recommendations. International policy and legislative frameworks such as the United Kingdom’s *Climate Change Act* and Climate Change Committee should be considered. Further thoughts are set out in Section 9.

Section 2 – Greenhouse Gas Emissions

2a – Breakdown & Context

46. The following figures provide a breakdown and context for RMI’s GHG emissions:

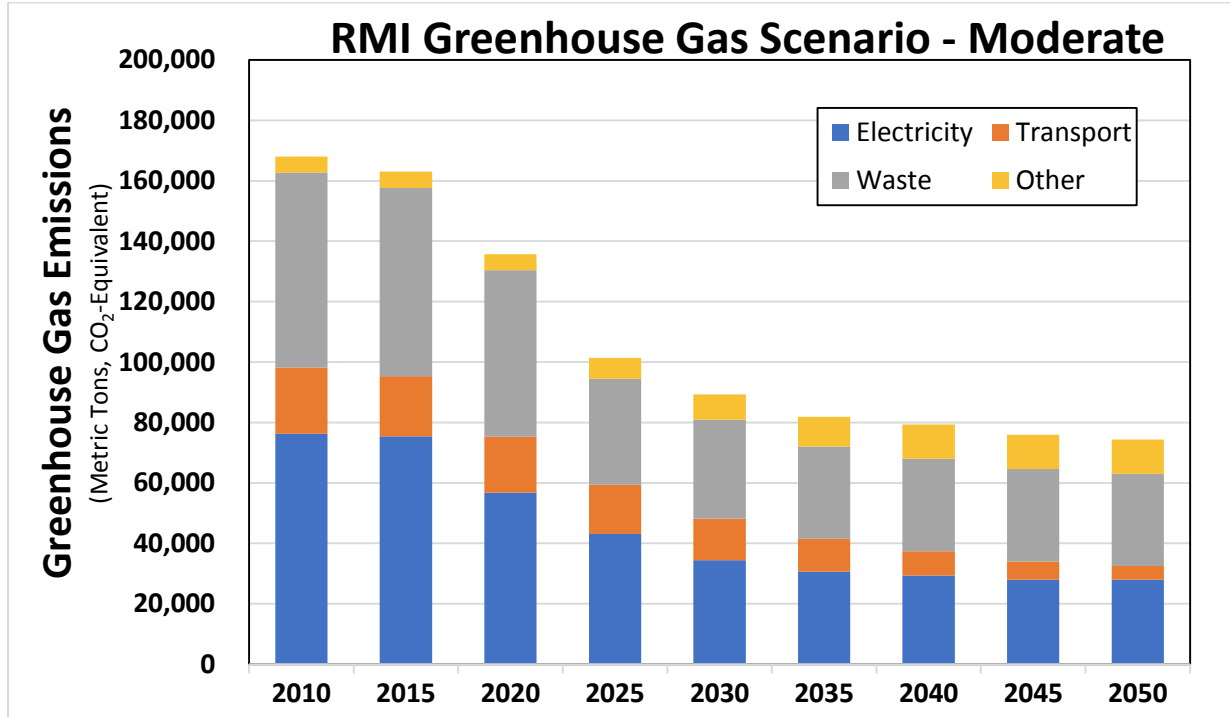


Figure 2: Moderate Scenario projection breakdown by sector

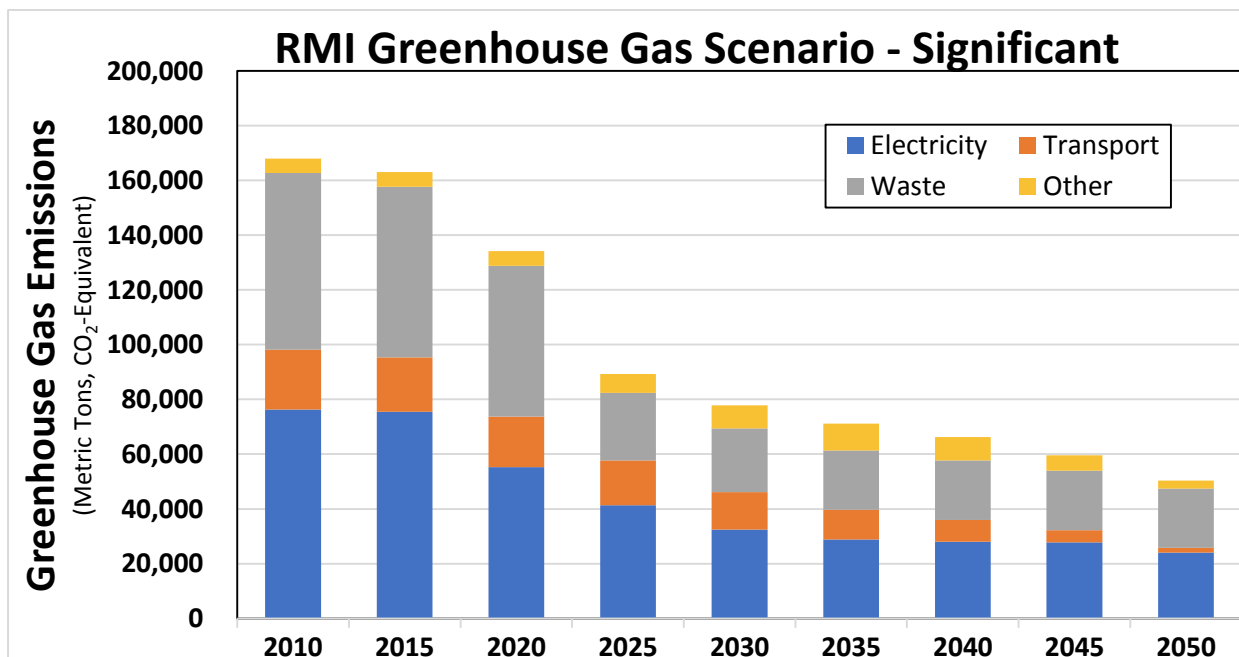


Figure 3: Significant Scenario projection breakdown by sector

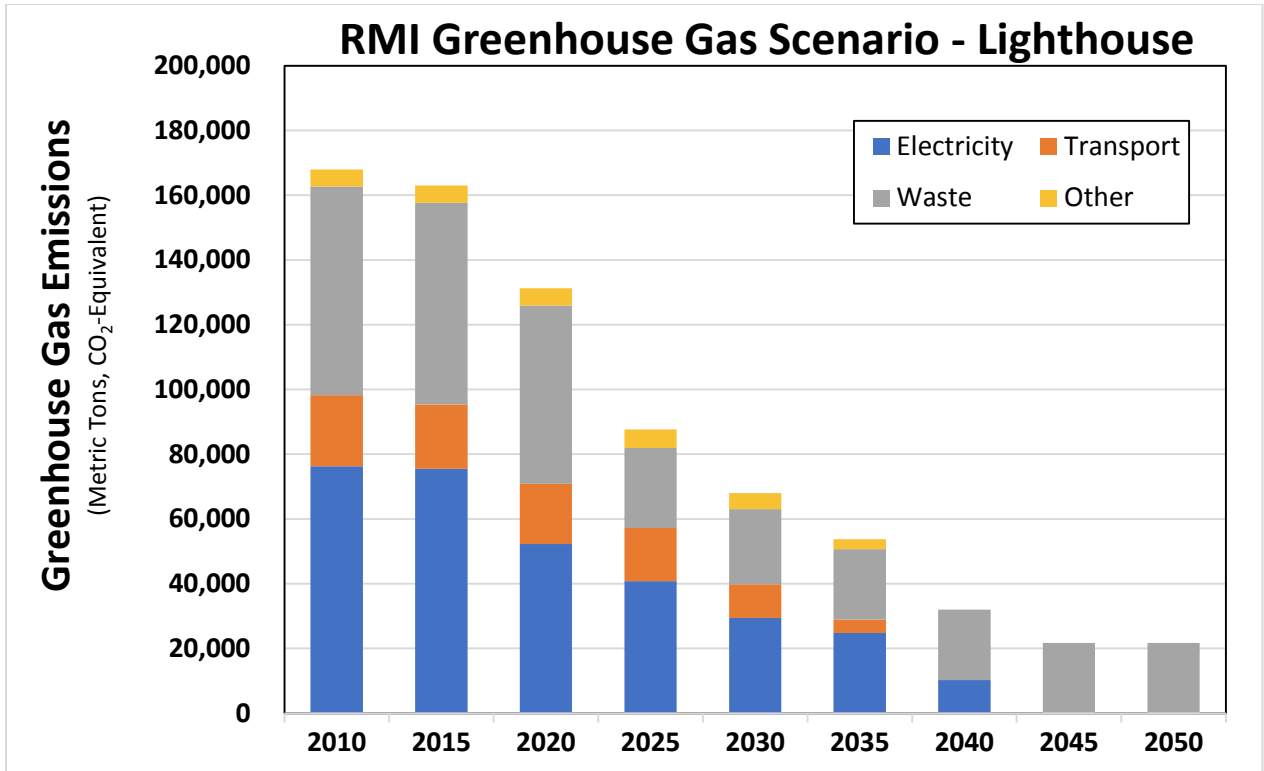


Figure 4: Lighthouse Scenario projection breakdown by sector

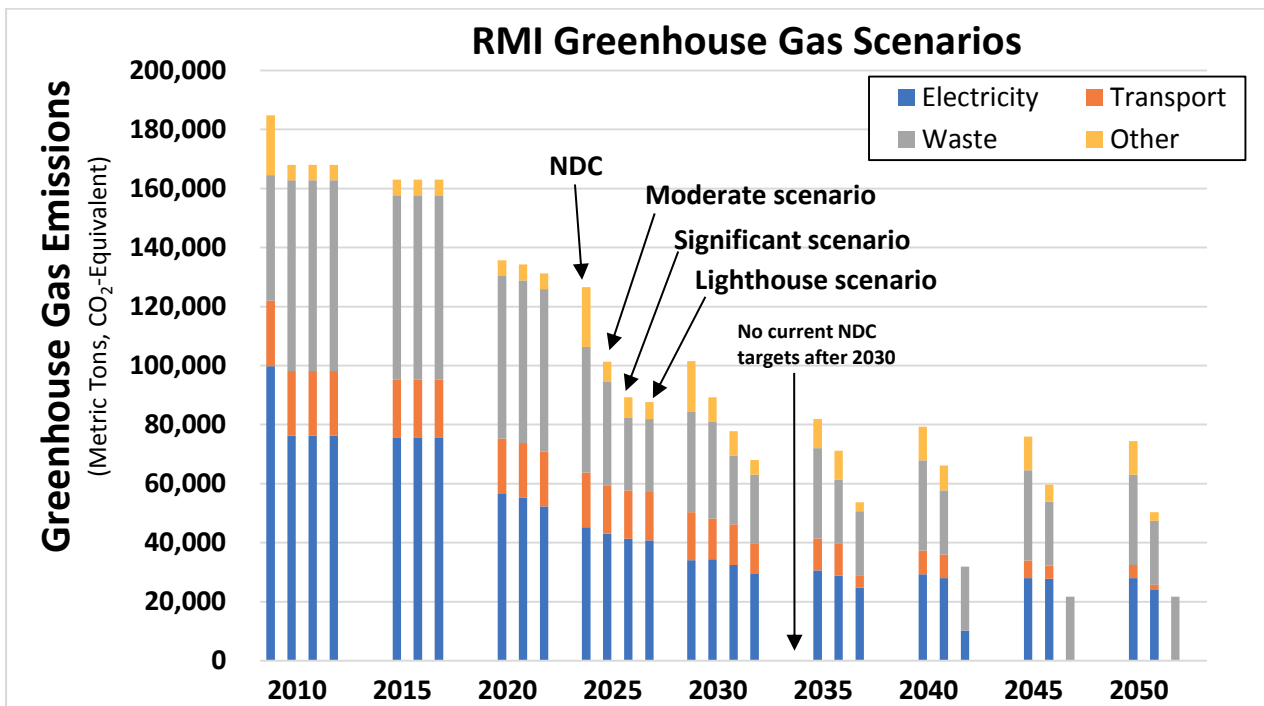


Figure 5: Snapshot comparisons of Scenarios by sector and year

2b – Electricity

Headline Recommendations

- **Focus** – particularly in the short and medium term – on the electricity sector to implement GHG emissions reductions targets;
- **Complete and implement** RMI’s Electricity Roadmap, which will provide further detail on least-cost technology pathways for how the electricity sector can be further decarbonized;
- **Invest** in electricity grid upgrades to improve grid stability, minimize system losses and accommodate more variable generation from renewable energy;
- **Undertake** a feasibility study to assess the potential for vehicle to grid electricity storage, which would provide dual benefits of reducing transportation emissions and providing stability to the grid. RMI should also consider thermal storage options;
- **Review** the governance relationship between the RMI Government and the electric utilities, including to ensure national mandates are implemented by the electricity generating sector; and
- **Consider** passing an Energy Sector Management Act to clarify powers and responsibilities among Government agencies to streamline decarbonization policies across the energy sector.

Summary

47. The electricity sector has by far the greatest potential to rapidly reduce RMI’s GHG emissions in line with its 2025 and 2030 NDC targets. As such RMI’s decarbonization pathway relies primarily on transitioning the electricity sector away from fossil fuels. It is estimated that at least 10% of RMI’s GDP is spent on importing fossil fuels for electricity generation alone. This represents a significant national cost. Furthermore, the heavy reliance on fossil fuel imports represents a highly significant energy security risk. Being at the end of the supply chain due to its remote location, RMI is highly susceptible to changes in supply due to geopolitical shocks or fuel price spikes.
48. At present, electricity generation is almost exclusively reliant on diesel fuel. While a full-scale shift to renewable energy is imperative, in the short to medium-term, RMI must leverage a combination of demand and supply-side reductions to reduce GHG emissions and facilitate the long-term transition.
49. Current policies only look out to 2020 – and not to 2025 or 2030 – and therefore do not fully implement RMI’s NDC. Policies in the energy sector will need to be

developed – based on solid analysis – that look well beyond 2020. These will need to be accompanied by a solid and rigorous long-term financial plan. The forthcoming Electricity Roadmap will be a positive step towards addressing some of these concerns.

50. Majuro, home to RMI's largest electricity grid, must undertake a combination of:
 - upgrading the electricity grid to reduce system losses;
 - pursuing demand-side energy efficiency upgrades;
 - replacing existing diesel generators with high speed engines;
 - increasing solar and wind penetration on the grid; and
 - installing storage capacity.
51. Upgrading the grid could bring much needed supply-side efficiency improvements and also accommodate projected increases in demand from new industrial facilities (e.g. a proposed fish processing plant in Majuro) and potential electrification of land-based transportation. Upgrading the grid is also a necessary step to allow for more variable generation (e.g. wind and solar).
52. It is estimated that there are up to 30% energy losses in the current grid – although there are a lot of uncertainties around this figure, which is based on comparing production and billing. These losses are made up of:
 - energy 'lost' to run the power station – estimated to be about 7%;
 - distribution network losses through transmission lines and transformers – estimated to be about 7%; and
 - energy theft – estimated to be around 15%.
53. It may be technically feasible to reduce losses to as little as 5%. As such, reducing grid losses could provide RMI with significant cost savings and GHG emissions reduction potential. Policies should be urgently developed to address this. New electricity meters, for example, would facilitate a better understanding of energy losses by comparing what comes out of transformers to what is billed.
54. Demand-side efficiency improvements should also be considered, such as appliance standards for air conditioning units and building code reforms to reduce electricity demand for cooling.
55. RMI should consider novel and variable tariff structures for electricity consumers – to maximize social access to energy and lower costs for all citizens while disincentivizing overuse. The current policy of providing landowners with 1000kWh free per month should be reviewed for consistency with trying to curtail GHG emissions through reduced energy use.
56. Policies will also need to be developed in relation to independent producers of renewable energy, including in relation to possible feed-in tariffs. A lack of regulation in this area could be problematic in terms of developing grid capacity for renewable energy in a logical and planned way. The impact of independent renewable energy production on the Marshall Energy Company (**MEC**) will also need to be considered.

57. Current diesel engines are manually controlled and incompatible with high penetration of renewable energy on the present grid system. Installing high-speed diesel engines would be needed to address supply fluctuations from variable generation until adequate energy storage is added to the grid. As such, an upgrade to diesel generation would facilitate greater penetration of renewable energy. As the penetration of renewable energy increases, the use of diesel could be downscaled – provided that the right kind of diesel generators are chosen at the outset. In the future these engines could theoretically be run on biodiesel, although this would not reduce RMI’s GHG emissions unless procured from sustainable sources.
58. RMI also has extensive coconut oil production (copra), which can potentially be used as either a renewable fuel for transportation or for electricity generation. However, there is limited land area available and copra is a key source of foreign exchange and economic prosperity for RMI. As a starting point for national discussion, it has been assumed that 50% of the available crop could in future be devoted to electricity generation. For this to make economic sense, world copra prices need to be lower than diesel prices. This use of copra can complement renewables, providing power during cloud cover, at night, and during low wind periods, allowing higher levels of renewable penetration.
59. An alternative would be to leapfrog diesel upgrading and move directly to greater renewables combined with storage – but this would require a considerable up-front investment in storage as well as grid infrastructure. In any event, any decision to invest in new diesel needs to be made in the context of, and balanced against, reducing battery costs in relation to renewable energy storage as a source of baseload.
60. There remain significant uncertainties over levels of fuel imports used for electricity generation. Policies should be put in place to improve data collection – including more granularity on how imported fuel is used once on island – as well as to improve access to such data (much of which lies in the hands of commercial organizations) by the RMI Government and relevant agencies.
61. A major constraint to solar penetration aside from electricity grid limitations is the lack of land area in RMI. There is about 7 megawatts (**MW**) worth of existing usable space on land and roofs. Majuro would need nearly 40 MW of solar capacity installed (with storage) to decarbonize its electricity grid based on current demand. Many buildings in Majuro lack the structural capacity to support rooftop solar. A lack of policy in this area poses a very real barrier to the roll out of renewable energy in the urbanized areas of RMI. As such, there is a need to urgently develop policy, such as:
 - the use of novel approaches to install solar (e.g. schools, basketball courts, hospitals, airport, etc.);
 - the potential use of floating solar panels for the reservoir by the airport or options for using floating solar in the lagoon, including addressing related land rights issues. Such options could be cheaper than land mounted solar; and

- a consistent and comprehensive approach for negotiating relevant access contracts for placement of solar panels.
62. Ebeye – the second largest grid in RMI – could follow a similar path to electricity sector decarbonization as Majuro. According to the International Renewable Energy Agency’s (*IRENA*) 2015 Renewables Readiness Assessment, Ebeye’s grid losses are considerably smaller than Majuro’s due to its size and the density of its population. Grid upgrades may still be necessary to allow for increased solar penetration.
 63. For electricity storage, which is essential as renewable energy penetration for electricity generation increases, a mixture of stationary batteries, thermal storage, and electric vehicles (which can provide vehicle to grid storage), has been assumed in the Scenarios set out in this 2050 Strategy.
 64. Electric vehicles could play a role in electricity storage in the two main population centers of Majuro and Ebeye. Vehicle to grid storage would allow RMI to simultaneously reduce transportation emissions and help stabilize the grid in response to the growing variability in electricity production introduced by the rising penetration of renewable energy. This may require infrastructure upgrades to facilitate bi-directional electricity flows to and from the grid. As a first step, a feasibility study should be conducted.
 65. The remaining major population centers (Jaluit, Wotje, and Kili) operate micro-grids powered by diesel. Demand in these micro-grids would not justify short-term investments in high-speed diesel engine upgrades. These micro-grids may therefore need to wait until they can be upgraded directly to a grid-connected solar system with energy storage. Off-grid solar can perhaps be pursued in the intervening period. In the outer atolls, the electricity sector is theoretically already decarbonized through off-grid stand-alone solar systems. However, the expansion of these systems and their long-term maintenance ought to be given further consideration.
 66. In all of the Scenarios considered, solar photovoltaics have been found to be the most viable renewable resource for RMI to achieve full decarbonization. While wind may also be a viable resource, it is still in its nascent stages in RMI. The lack of available land in RMI suggests that wind may need to play a significant role in the country’s future renewable energy mix. Feasibility studies in this area should be undertaken.
 67. Whilst data collection and availability for the electricity sector is relatively well developed compared to other sectors, there still seem to be significant uncertainties. This is an area where improvement would assist in more accurate policy development and projections. Studies have, for example, tended to focus mainly on Majuro.
 68. Ocean Thermal Energy Conversion (*OTEC*) has been previously proposed as a moonshot technology that could significantly contribute to RMI’s decarbonization efforts and also make it an energy exporter. Feasibility studies for a proposed pilot project on Kwajalein have shown promise but two factors impede progress: lack of adequate demand; and absence of adequate financial capital. A power purchase

agreement (**PPA**) with the US Army to supply electricity to the military base on Kwajalein would be necessary to address concerns around adequate demand as RMI alone would not justify the investment in an OTEC plant. Furthermore, raising financial capital is difficult as RMI is credit-constrained and would have to rely on private capital and grants to fund a pilot project. This can perhaps be overcome by stressing the economic co-benefits of OTEC as excess electricity can be used to produce hydrogen fuel, which can be employed domestically and sold on the international market. Additionally, OTEC can also be a freshwater resource and provide drought resilience for RMI.

69. As RMI looks towards full electricity decarbonization, the relationship between the Government and electric utilities will need to be reviewed to ensure that effective and efficient structures are in place to drive and oversee the transition to 100% renewable energy. For example, while the governance structure of the MEC and Kwajalein Atoll Joint Utility Resources (**KAJUR**) allow for limited Government influence, the extent of this influence is ambiguous – in particular from the external perspective of donors and development banks – and could usefully be clarified.
70. Another important governance question is the role of the Energy Planning Division (**EPD**) within the Ministry of Resources and Development (**R&D**). While EPD is meant to be the “focal point for all energy-related activities and initiatives” it currently lacks the regulatory authority necessary to drive a comprehensive decarbonization policy. An Energy Sector Management Act has been proposed “to clarify powers and responsibilities within Government for energy” but has yet to be drafted and passed by the *Nitijela*. Addressing this should be a priority.

Potential measures and next steps

Area	Sub-Area	Measure	Feasibility Assessments	Pilot Actions
Stationary Electricity	Generation	Diesel Generator Efficiency / Rapid Response	Evaluate the best time to upgrade diesel engines to fast start technology and how to use this to expand renewable usage. Increase priority for this equipment. If coconut usage will be high over the long term, see comments below.	
		Solar	Evaluate the feasibility of increasing solar penetration on Majuro (which is likely possible if automated SCADA and dispatch best practices are implemented (see below)).	Pilot floating solar arrays in RMI, and collect solar insolation data near population centers of Majuro and Ebeye to reduce solar financing uncertainty.
		Wind	To eliminate transmission costs, a wind plant will need to be located as close to the current MEC electricity plant as possible. Put up a wind tower to measure wind speeds	

	Storage		for a few years, to establish whether wind availability is high enough to warrant wind use; and verify that land (even slightly offshore if needed) near this location is available.	
		Coconut Oil	Given RMI economics, and the export value of coconut oil, decide what proportion of the coconut crop it makes sense to eventually devote to electricity production; in addition, examine if crop yield/acreage can be expanded and/or what levels of oil usage make sense.	
			With coconut oil viscosity higher than diesel, it should be feasible to use the waste heat from the current diesel engines to pre-heat the coconut oil to allow much higher blend rates. Continue current studies and see if this is feasible in a laboratory.	It will be critical that fast-starting diesel technology be compatible with coconut oil blends.
	Energy Efficiency	Automated SCADA/Dispatch/Forecasting	Examine best electric utility dispatch practices in the U.S. (whether automated, semi-automated, or manual), especially for low cost and at the RMI utility's size and implement automated dispatch at 15-minute intervals if possible.	
		Vehicle to Grid Battery Storage		Continue electric vehicles pilots, and form a partnership with vehicle to grid storage software/hardware vendors, and pilot this aspect as well
		Battery Storage	Vehicle to grid battery capacity appears to be the most economic, but other utility battery storage vendors are starting to offer products. Examine costs, land requirements, and maintenance / salt corrosion for utility scale battery storage, to determine whether/which non-vehicle to grid technology RMI should pilot.	If attractive technology is found, partner with vendors as a test/pilot site.
		Thermal Storage	Examine which thermal storage technologies are technically and economically feasible in RMI.	Pilot these technologies, especially with regards to maintenance and salt/air corrosion.
		Replace all A/C with Wet Cooling Towers / Seawater ASHPs	Assess Majuro's and Ebeye's air conditioning infrastructure, identifying the equipment's condition and type, to verify if shifting to seawater-source heat pumps, and/or water-cooling towers, is viable, and what efficiency gains are reasonable. (As was done for the infrastructure report, RMI may be able to recruit military base personnel to provide technical expertise.)	Look for other tropical climate pilots as examples, and pilot these technologies on RMI.
		Improve Building Codes /	Assess RMI's buildings' insulation levels, and the potential for savings through improved building codes	Launch a building

		Enforcement	and/or building retrofits. (As above, military base personnel may be a resource, or energy efficiency code professionals from the U.S. or elsewhere.)	insulation retrofit program, and/or improve building codes and enforcement.
		Other Appliances	Conduct a survey study, if not already done, to determine what types of equipment Majuro's electricity supplies, and what efficiency levels these pieces of equipment operate at. This will include water pumps (already described in the infrastructure report), air conditioning, lighting, other electric motors, etc. Examine maintenance levels as well, to assess potential for efficiency improvement and next steps (i.e. efficiency standards, improved maintenance regimes/enclosures, etc.).	

Figure 6: Electricity - potential measures and next steps

Key Assumptions

Electricity — Renewables

71. Assumption: the renewable potential in RMI involves a significant role for biomass (coconut oil), wind, and solar photovoltaics.
72. Assumption: 50% of the current coconut oil crop can be used to generate electricity while the remaining 50% would be sold on the open market, either domestically or for export. Coconut oil would first be used for stationary energy rather than transportation or heating applications. As such, it could eventually replace approximately 12% of diesel used to generate electricity.
73. Wind power could make up several MW of RMI's renewable generation, thanks to the improvement of technology and the availability of RMI's atolls as pre-built offshore wind platforms. Current wind data appears indeed to be above economical thresholds in the US Midwest. Assumption: one to two 1.5-2.5 MW turbines can be used in Majuro, as wind's generation profile is complementary to solar.
74. Land is scarce in RMI, and non-government rooftops are not structurally capable of supporting PV arrays. Assumption: RMI will use floating photovoltaics arrays when it runs out of appropriate rooftop space.

Electricity — Storage

75. At higher renewable levels, some form of energy storage is necessary. Assumption in the Moderate Scenario: no storage is developed, and renewable energy generation is therefore capped. Assumption in the Lighthouse Scenario: storage comes from a combination of thermal storage technologies and grid-to-electric vehicle storage.

Electricity — Energy Efficiency

76. **Assumption:** Majuro electricity loss improvement efforts will reduce losses from 30% to 20% in 2025.
77. **Assumption:** 25% (Moderate) and 50% (Lighthouse) end use energy efficiency improvements by 2050. This will come from a combination of insulation improvements (retrofits, building codes), electrical grid loss reductions (from 30% losses to 20% by 2025), air conditioning improvements (seawater heat pumps and water-cooling towers appear to be able to achieve a 50% efficiency improvement), and other higher efficiency appliances (water pumps, motors, etc.).

Sector Definitions

78. Emissions from current diesel generators that generate power for Majuro, the capital, and Ebeye, an island with 28% of RMI’s population of 52,000.
79. Only these two grids are modeled, covering 79% of the population (there are a few outlying grids on other islands).

Scenario Definitions

80. Figure 7 below provides a more detailed description of assumptions used for the scenario projections. Each row represents a measure that may be put in place to reduce emissions. In some cases, measures are combined (e.g. a variety of end user efficiency measures are delineated by row; these are modeled as an overall improvement in end user efficiency).

Area	Measure	NDC		Millennium Consumption Goals (MCG) Moderate	MCG Lighthouse Scenario (the Significant Scenario has the same efficiency assumption but is 15 years delayed)
		2025	2030		
		Mtons Reduced	Additional Mtons Reduced		
Electricity	Energy Efficiency Demand: Prepay Meter	1,5	0,7	Included in overall 25% reduction target across all end user efficiencies.	Included in overall 50% reduction target across all end user efficiencies.
	Energy Efficiency End User Improvement	19,2	26,1		
	Diesel Generator Efficiency / Rapid Response	6,2	3,7	10% reduction in 2025.	

Diesel Heat Recovery	3,8	0		
Solar	19,2	29,9	Total radiant energy (RE) capped at 30% of grid (ramping w/ fast diesel/SCADA).	100% RE w/ battery/thermal storage.
Wind	0,8	1,5	2,5 MW single turbine @ MEC gen plant.	5 MW 2 turbines @ MEC gen plant.
Coconut Oil	3,8	3,7	Use 50% available coconut for electricity generation phase in, 50% by 2035.	
Vehicle to Grid Battery Storage				Convert all cars/trucks to electric vehicles.
Automated SCADA/Dispatch/Forecasting			In place by 2025.	
Battery Storage				Covers 2/3 of storage needed.
Curtailement			Not used.	
Commercial/Residential Demand Response				
Thermal Storage				Covers 1/3 of storage needed.
Replace all A/C with Wet Cooling Towers/Seawater ASHP's			Major driver in the 25%/50% end use efficiency improvement. Can potentially double efficiency (see VHAC efficiency sheet).	
Improve Building Codes/ Enforcement			Major driver in the 25%/50% end use efficiency improvement. Improved isolation is particularly important.	

Figure 7: Electricity – Scenario definitions

2c – The Waste Sector

Headline Recommendations

- **Focus** – in the medium term out to 2030 – on policies and plans to reduce RMI’s significant and growing waste problem on the social and wider environmental benefits of taking action rather than reduction of GHG emissions;
- **Develop** policies and measures to minimize the level of organic material in collected waste – including a focus on local composting;
- **Analyze** further the feasibility of generating energy from waste and the corresponding GHG benefits;
- **Assess** future plans for the landfilling of waste carefully against RMI’s long-term goals of achieving net zero emissions by 2050 and for environmental impacts. Apart from using waste for land reclamation, landfill is not recommended as a primary policy to deal with waste;
- **Review** the powers of the RMI Government to ensure they are fit for the purpose of developing and implementing relevant policies and measures. The 2008 draft waste strategy should be finalized, taking into account the latest data and this 2050 Strategy; and
- **Extend** waste collection throughout the whole of Majuro to minimize the use of illegal waste dumps.

Summary

81. Waste accounts for nearly a quarter of RMIs total GHG emissions, and if the country is to move towards net zero GHG emissions, this sector will need to be addressed. However, the waste sector is by far the most difficult of RMI’s sectors to decarbonize.
82. As such, and given that most of RMI’s GHG emissions reductions potential for its 2025 and 2030 NDC targets will be delivered through the energy sector, the country should not look to the waste sector as a significant contributor to reduce GHG emissions in the short to medium term. Rather, planning out to 2030 should focus on social benefits and the wider environmental advantages of dealing with the RMI’s significant and growing waste problem.
83. Having said that, dealing with waste and reducing GHG emissions in an economically feasible way are not mutually exclusive. Planning for this sector should therefore align and be consistent with RMI’s 2050 goal.

84. A successful feasibility study for a 1.2 MW waste-to-energy (**WTE**) plant in Majuro was conducted in 2010. WTE would substantially reduce RMI's waste-related emissions thanks to the reduction of methane emissions. Furthermore, a WTE plant could provide baseload power for RMI, at least partially eliminating the short to medium-term need for diesel-powered electricity generation. This would provide the dual benefit of reducing waste as well as decreasing the need for imported fossil fuel.
85. There are, however, operational concerns that are barriers to adopting WTE in RMI such as the lack of a reliable waste stream to run a WTE facility. One option might be for RMI to consider in further detail the potential to import waste from other atolls. In particular, waste from Ebeye (combined with Majuro) could perhaps provide a steady waste stream. In any event, further feasibility analysis of WTE potential should be carried out.
86. The Majuro Atoll Waste Company (**MAWC**) is looking into building an incineration facility to address space constraints in Majuro. This could have some GHG reduction potential but, as with WTE, localized air pollution risks could be a concern.
87. Landfilling waste in RMI could, if planned and managed well, deliver co-benefits such as creating new land or as part of coastal defenses. However, landfilling of organic waste will very likely be inconsistent with RMI's goal of net zero emissions by 2050 because recovery of GHG emissions from landfill is technically difficult and resource intensive, generally requiring significant amounts of freshwater and soil.
88. As such, very careful thought needs to be given as to whether or not to invest in landfill. Given the general unsuitability of RMI for landfill, a WTE approach might be more preferable and more consistent with the overall vision of moving towards net zero emissions by 2050. If landfilling is pursued, methods such as a "Fukuoka" style landfill, which reduces methane emissions by 50% compared to standard landfills, should be considered.
89. To date, the Environmental Protection Agency (**EPA**) has sought to reduce solid and toxic waste that pose direct threats to human health. Going forward, given that waste management in the outer atolls would be difficult to oversee, RMI should focus its efforts on reducing organic waste – the major driver of waste-related GHG emissions – in its major population centers, specifically in Majuro and Ebeye. Urgent priority needs to be given to local composting of organic material and separating out organic materials from the general waste stream. Local initiatives such as composting will be key to this.
90. Waste collection should be urgently extended throughout Majuro. This should assist in minimizing the use of illegal waste dumps, burning, burying or dumping of waste into the ocean – including of toxic wastes.
91. Government authority over waste management is relatively decentralized in RMI, which complicates national efforts to reduce waste-related emissions as there is no clear responsibility for national policy. The ad hoc reliance on the EPA for this purpose – which is an enforcement agency – is far from ideal. Government powers should be reviewed for adequacy to ensure they are fit for purpose. As part of

that, the 2008 draft waste strategy should be finalized, taking into account the latest data and this 2050 Strategy.

92. A fundamental problem is that the vast majority (up to 90%) of what is imported to RMI stays here. Consideration should be given to introducing policies to:
- influence the nature and types of material that are imported, with the aim of reducing waste – for example by discouraging importation of packaging materials that cannot be economically recycled or are not biodegradable (e.g. banning or reducing the import of plastic bottles or plastic bags);
 - incentivize recycling (e.g. through deposit schemes);
 - improve waste reduction across all atolls through public education programs and existing Government mandates.
93. Many waste studies have been conducted in RMI, which have generated a wealth of data. It is recommended that these are consolidated. An overarching study could be launched, and a comprehensive policy consequently developed based on the study’s conclusions. As part of this, RMI should complete the development of its national waste strategy, initiated in 2008 in conjunction with the South Pacific Regional Environment Program (**SPREP**).

Potential Measures and Next Steps

Area	Measure	Feasibility Assessment	Pilot Actions
Waste	“Fukuoka” Landfill Site	Implement a “Fukuoka” landfill site at/near the current site, verifying post landfill site use (aka Japan, elsewhere); clean up and close the current site.	
	Incinerate Waste rather than Uncontrolled Burning	As recommended by the Japanese waste team, explore the opportunity for large-scale public incineration to reduce landfill volumes. Incineration will increase emissions but is safer than current uncontrolled burning.	
	Disposable Container Ban	As part of education on recycling and reuse, consider a disposable container ban and explore tactics on how to increase recycling rates to match US and/or European Union (EU) levels.	
	Improve Recycling, Education, Regulation Enforcement, Reducing Landfill Volumes		

Figure 8: The Waste Sector – potential measures and next steps

Key Assumptions

94. Assumption in both Moderate and Lighthouse Scenarios: the Majuro landfill is over capacity and therefore should be closed and replaced with a "Fukuoka" style landfill, which reduces methane emissions by 50% compared to standard landfills.
95. WTE incineration can reduce landfill volumes/land requirements but has higher eventual emissions. Assumption: incineration in the Moderate Scenario, but not for the Lighthouse Scenario.
96. Assumption: RMI can achieve higher recycling levels by 2050, reaching current US levels by 2025 and current EU levels by 2040 in all Scenarios.

Sector Definition

97. Municipal solid waste, incineration/burning, and waste water treatment emissions for Majuro and Ebeye. We use a 2017 waste survey's estimate of open burning to include burning emissions in the GHG inventory, in contrast to the Second National Communication where these emissions are not accounted for.

Scenario Definitions

98. Figure 9 below provides a more detailed description of assumptions used for the scenario projections. Each row represents a measure that may be put in place to reduce emissions.

Area	Measure	NDC		MCG Moderate	MCG Lighthouse (Significant Scenario has the same efficiency assumption but is 15 years delayed)
		2025	2030		
		Mtons Reduced	Additional Mtons Reduced		
Waste	"Fukuoka" Landfill Site			Reduces methane emissions by 50% compared to standard landfill.	
	Incinerate Waste rather than Uncontrolled Burning			Reduces landfill volume by 80% when ashes are buried. However, not all material can be incinerated after collection.	Incineration not used and burning on Majuro and Ebeye banned; requires more landfill space, but Fukuoka landfill technique allows productive use after land is used as landfill.

	Disposable Container Ban			Assume current 8% recycling rate increases to 35% (US average) by 2025, and then 45% (EU average) by 2035.
	Improve Recycling, Education, Regulation Enforcement, Reducing Landfill Volumes			
	"Collect and Burn Methane Producers"		8,5	

Figure 9: The Waste Sector – sector definitions

2d – Domestic Transportation – Land based

Headline Recommendations

- **Develop** policies to encourage a greater use of public transport, as well as cycling and walking, and to reduce the reliance and demand on private vehicles;
- **Commission** further analysis to identify policy options to increase the uptake of electric vehicles;
- **Consider** policies to require Government departments and agencies to transition to electric vehicles; and
- **Improve** data collection, including on what proportion of imported fossil fuels are used by domestic land transport.

Summary

99. The decarbonization pathway for land transportation would require the electrification of the transportation fleet with the possibility of also leveraging low and zero-carbon fuel sources such as biofuel and hydrogen.
100. These alternative fuel sources currently show little promise. Hydrogen-powered vehicles are only plausible if OTEC becomes viable and offers RMI a cheap stream of hydrogen fuel.
101. Most likely RMI will largely need to transition its land transportation fleet to electric vehicles. A three-year pilot project in Majuro funded by Japan is testing the viability of solar powered electric vehicles. The results of this pilot should be analyzed and disseminated.

102. Five main barriers would need to be addressed to increase the penetration of electric vehicles in RMI:
 - the absence of clear institutional authority to mandate/facilitate the uptake of electric vehicles;
 - the relative cost of electric vehicles;
 - the lack of charging infrastructure;
 - the current limits of electricity generation;
 - the prohibitive cost, especially to the public.
103. The relationship between increased use of electric vehicles and increased electricity demand will need to be further explored. Policies in both areas will need to be consistent.
104. The major impediment to decarbonizing the land transportation sector is the absence of clear institutional authority that can mandate electric vehicle sales and make the necessary infrastructure upgrades (e.g. charging stations) to support electric vehicles. While the Government could leverage existing laws (i.e. the Import Duties Act) to encourage the purchase of fuel-efficient and/or electric vehicles, an implementing/planning agency would still be necessary but currently does not exist. In the intervening period, Government agencies should be the initial adopters of these vehicles.
105. In any event, RMI should commission further analysis of the potential to transition towards electric land-based transport, covering challenges, solutions and opportunities as a basis for informed policy development. Hard and soft policy options could include:
 - tax incentives for the importation of electric vehicles;
 - transitioning the Government fleet to electric vehicles;
 - transitioning the taxi fleet to electric vehicles;
 - the use of golf carts – as is the case with the US military base on Kwajalein.
106. In future RMI could consider vehicle to grid storage, further integrating decarbonization efforts of the transportation and electricity sectors.
107. There is considerable uncertainty as to what proportion of RMI's imported fossil fuels is used for domestic land transport. Better data will be needed to establish a baseline, develop informed policies and monitor progress towards net zero GHG emissions in this sector.
108. As a first step, however, RMI should consider developing policies to encourage a greater use of public transport, as well as cycling and walking, and to reduce the reliance and demand on private vehicles. Increased cycling and walking in particular would have a number of co-benefits, including reduced pollution and improved public health.
109. Hard and soft policy options to incentivize walking and cycling could include:

- improved urban planning – such as clearly demarcated cycling and walking paths with shade;
- public and school education programs;
- school cycle training programs;
- cycle hire schemes;
- cycle to work schemes, where the Government and private sector workers could have the up-front cost of cycle purchase deferred;
- encouraging Government workers to use Government cycles to travel between different departments.

110. The social impacts, including gender issues, of such options will need to be carefully considered.

Potential Measures and Next Steps

Area	Measure	Feasibility Assessment	Pilot Actions
Transportation	Land Efficiency Improvements	Inventory current vehicle stock and efficiency level. Examine current efficiency standards on RMI, higher US Corporate Average Fuel Economy (CAFE) standards, and available technologies to determine further action (higher standards, cash for clunkers, better efficiency standard enforcement, better maintenance/catalytic converter enforcement, etc.).	
	Electric Vehicles		Continue electric vehicles' pilots, especially examining market barriers, and/or maintenance issues.
	Multi-modal initiatives: Regular Island Shuttles; Electric Bikes	Take a deeper look at citizens' transportation needs, mapping total trips per year and mode (air, sea, car, bike, walking, etc.). Assess the frequency, timing, and purpose of these trips to see whether/what form of public transportation and/or bicycling programs may make sense.	

Figure 10: Land based transport – potential measures and next steps

Key Assumptions

111. Assumption: 20% efficiency improvement in vehicles to 2050 (per US CAFE standards), and in the Lighthouse Scenario that RMI will shift to using 100% electric vehicles.

Sector Definition

112. Emissions are based on approximately 2700 vehicles in Majuro and Ebeye. Air and ship emissions have been modelled but are excluded from this analysis as “pass-through emissions” and are therefore not counted in national totals. This is consistent with the RMI GHG inventory done as part of the Second National Communication published in 2015.

Scenario Definitions

113. Figure 11 below provides a more detailed description of assumptions used for the scenario projections. Each row represents a measure that may be put in place to reduce emissions.

Area	Measure	NDC		MCG Moderate	MCG Lighthouse (the Significant Scenario has the same efficiency assumptions, but is 15 years delayed)
		2025	2030		
		Mtons Reduced	Additional Mtons reduced		
Transportation	Land Efficiency Improvements	1,5	2,4	4% reduced/ 5 years for 25 years.	
	Air Improved Efficiency		0,2	0.3% reduced every 5 years.	
	Electric Vehicles				Get to 100% penetration over time.
	Multi-modal Initiatives: Regular Island Shuttle; Electric Bikes			Reduce Vehicle Miles Travelled (VMT) by 1% / 5 years for 25 years.	
	Biofuels for Air/Ship Applications			RMI does not have enough coconut supply to begin using these.	

Figure 11: Land based transport – Scenario definitions

2e – Domestic Transportation – Ocean based

Headline Recommendations

- **Improve** data collection to better illustrate what proportion of imported fossil fuels are used by domestic sea-based transport;
- **Explore** options to reduce GHG emissions from domestic ocean-based transport, including by using the results of the GIZ/University of the South Pacific (*USP*) Low Carbon Sea Transport Transition Project (*LCSTTP*); and
- **Consider** institutional reforms that will allow the Ministry of Transport and Communication (*MTC*) to exercise more effective regulatory control over the operational aspects of domestic sea transport in addition to managing the infrastructure.

Summary

114. Domestic shipping is responsible for approximately a third of RMI's fuel consumption. RMI was the only country to explicitly include domestic shipping in its 2025 NDC and has led the way – as the world's second biggest flag registry – to encourage efforts to decarbonize international shipping at the International Maritime Organization (*IMO*).
115. There are a number of interventions that RMI can pursue in the short to medium-term to achieve a low-carbon pathway for domestic sea transportation. These include:
 - changes to ship design;
 - changes to operations;
 - fuel switching/mixing;
 - improved docking facilities to reduce the amount of time (and fuel) required to load and unload ships.
116. These efficiency improvements can also provide economic benefits through avoided costs from fuel imports.
117. A pathway to full decarbonization for sea transport, however, appears to be unfeasible in the medium term. RMI should carefully monitor and reap the benefits of the GIZ's/USP's LCSTTP under the Micronesian Center for Sustainable Transport established in Majuro.

118. There is considerable uncertainty as to what proportion of RMI’s imported fossil fuels are used for domestic sea transport. Better data will be needed in order to establish a baseline, develop informed policies and monitor progress towards net zero GHG emissions in this sector. The initial baseline studies by the LCSTTP could prove very useful in this regard.
119. Considering RMI’s status as the second largest flag registry in the world, successful adoption of nascent low- or zero-carbon sea transport technologies at home could have ripple effects across the international shipping sector at large.
120. The MTC has administrative control over seaports but apparently lacks the authority to mandate conservation and efficiency improvements in sea transport. To more aggressively pursue a decarbonization strategy in sea transportation, RMI should consider institutional reforms that will allow the MTC to exercise more effective regulatory control over the operational aspects of domestic sea transport in addition to managing the infrastructure.

Potential Measures and Next Steps

Area	Measure	Feasibility Assessment	Pilot Actions
Transportation	Sea Efficiency Improvements	Examine both in-country fleet efficiency and equipment, and pass-through fleet efficiency and equipment. Examine potential standards and technical pathways for improvements (i.e. sails, engine efficiency improvement, etc.). Evaluate the economics and implications of various options (improved efficiency standards, lower carbon fuels, etc.) to find the best path forward.	

Figure 12: Ocean based transport – potential measures and next steps

Sector Definition

121. Emissions are based on approximately 2700 vehicles in Majuro and Ebeye. Air and ship emissions have been modelled but are excluded from this analysis as “pass-through emissions” and are therefore not counted in national totals. This is consistent with the RMI GHG inventory done as part of the Second National Communication published in 2015.

Scenario Definitions

122. Figure 13 below provides a more detailed description of assumptions used for the scenario projections. Each row represents a measure that may be put in place to reduce emissions.

Area	Measure	NDC		MCG Moderate	MCG Lighthouse (the Significant Scenario has the same efficiency assumption but is 15 years delayed)
		2025	2030		
		Mtons Reduced	Additional Mtons Reduced		
Transportation	Sea Efficiency Improvements	0,9	1,4	3% reduced / 5 years for 25 years (3 primary ferries to improve, not 1000s of vehicles).	
	Sea Coconut Oil Diesel Blends	1,3	2	Not a practical use of limited coconut oil supplies relative to electricity sector. Not used.	
	Air Improved Efficiency		0,2	0,3% reduced every 5 years.	
	Shipping: Require Efficiency Measures (Efficient Propellers, Sail Assist, Low-carbon Fuels...)			See Sea Efficiency Improvements above.	
	Biofuels for Air/Ship Applications			RMI does not have enough coconut supply to begin using these.	

Figure 13: Ocean based transport – Scenario definitions

2f – Cooking & Lighting

Headline Recommendations

- **Continue** efforts to phase out the use of kerosene for lighting and cooking;
- **Engage** women stakeholders as key players in this sector and empower women as entrepreneurs with capacity building and technology transfer; and
- **Establish** whether the Energy Planning Division (**EPD**) needs a more robust Government mandate in order to fully decarbonize these activities.

Summary

123. Kerosene and liquefied petroleum gas (**LPG**) used for cooking and lighting are significant contributors towards the ‘other’ sector listed in RMI’s GHG emissions inventory. In 2010, the base year used for RMI’s NDC, the ‘other’ sector accounted for nearly the same level of emissions as the transportation sector, underscoring its significance when considering RMI’s decarbonization pathway.
124. As a result of the electrification of RMI’s population centers, kerosene use for lighting has significantly declined. Similarly, the adoption of solar lighting in the outer atolls has also led to a decrease in kerosene use. RMI must continue these efforts to phase out the use of kerosene for lighting.
125. For cooking, due to public health concerns, particularly for women and children, RMI has already embarked on an aggressive low-carbon strategy encouraging the replacement of kerosene with LPG and efficient biomass cook-stoves (e.g. the ‘One Smokeless Stove Per Home’ project). However, the decarbonization pathway is less clear since electric/solar-powered stoves are not seen as viable at the moment.
126. RMI has made remarkable progress thus far with its existing institutional arrangements to reduce GHG emissions from cooking and lighting. The MEC, with a Government mandate, has moved forward with full electrification of urban households by 2015. RMI is also making great progress towards a 90% electrification target for rural households in the outer atolls.
127. The EPD has played a critical role in procuring and funneling development assistance to encourage the use of more efficient and environmentally friendly fuels for cooking. The lifestyle and economic benefits of eschewing kerosene have been natural drivers for a low-carbon pathway for cooking and lighting.
128. A more robust Government mandate to phase out GHG emissions from this sector may be needed to provide EPD with the mandate to undertake the final step towards decarbonization.

Potential Measures and Next Steps

Area	Measure	Feasibility Assessment	Pilot Actions
Other	LPG Efficiency Improvements	Similar to above infrastructure studies, examine cooking equipment used in RMI and their efficiency to determine actions needed relative to kerosene to LPG and other fuel switching.	
	Convert LPG Cooking to Electric	Explore the potential for cheaper solar power and time of use rates to incentivize users to switch loads to electric, particularly during the hours that solar generation is highest.	

Figure 14: Cooking & lighting – potential measures and next steps

Key Assumptions

129. Assumption: kerosene cooking will be phased out in favor of LPG by 2025, and in the Lighthouse Scenario electric cooking will be used to phase out LPG by 2050 as electricity prices become set by low solar array prices. This is valid for the Lighthouse Scenario only because storage is required, as most cooking occurs during non-sunlight hours.
-

Sector Definition

130. Emissions from residential, commercial and Government buildings. These are from kerosene and LPG used for cooking.
-

Scenario Definitions

131. Figure 15 below provides a more detailed description of assumptions used for the scenario projections. Each row represents a measure that may be put in place to reduce emissions.

Area	Measure	NDC		MCG Moderate	MCG Lighthouse (the Significant Scenario has the same efficiency assumption but is 15 years delayed)
		2025	2030		
		Mtons Reduced	Additional Mtons Reduced		
Other	LPG Efficiency Improvements		3,1	Assume remaining 6% kerosene for cooking is phased out for LPG; and for heating is phased out using heat pumps.	
	Convert LPG Cooking to Electric				Phased, assume 100% by 2035 (can only occur if storage is present, as most cooking is done in non-daylight hours).

Figure 15: 'Other' – Scenario definitions

Section 3 – Adaptation & Climate Resilience

Headline Recommendations

- **Review and consolidate** policies and measures on adaptation and climate resilience, as well as social and economic policies, to align with strategic principals and priorities, an understanding of recent and future impacts of climate change and a phased and adaptive approach to action;
- **Initiate**, as soon as possible, the process to develop a National Adaptation Plan (**NAP**) by the end of 2019. The NAP should:
 - incorporate adaptation and climate resilience milestones to be achieved, for example by 2020, 2025, 2030 and 2050, as well as suggest measures to achieve them;
 - elaborate immediate, accelerated gender-responsive actions and investments over the next 5 years (2019-2023) to adapt to the impacts of climate change and transition to climate resilience;
 - suggest, as appropriate, updates to relevant national policies and legislation;
 - set out a plan for significant investments in adaptation and resilience in order to be in a position to fully implement its recommendations;
 - incorporate, as appropriate, the key recommendations arising from the review of the JNAP;
- **Submit** RMI's Adaptation Communication to the UNFCCC by 2020 at the latest, setting out RMI's intended adaptation contribution to achieving the goals of the Paris Agreement;
- **Reflect** RMI's intention to produce a NAP and Adaptation Communication in its forthcoming NDC; and
- **Establish**, as soon as possible, financing pathways for adaptation, resilience and protection measures, particularly focusing on coastal resilience including coastal vulnerability assessments, as well as tackling critical knowledge gaps in key areas.

Summary

132. RMI's international climate change focus has been largely on mitigation and related issues. Even if the Paris Agreement goal of limiting global average temperature increases to 1.5 degrees Celsius is achieved, the serious impacts on a

climate vulnerable nation, such as RMI, will be considerable. Domestically, attention will urgently and increasingly need to focus on adaptation and climate change resilience.

133. RMI's existing adaptation policies are built around three pillars:
 - having a clear sense of strategic principals and priorities (e.g. RMI's inalienable right to exist and its exceptional status as an atoll nation);
 - an understanding of recent and future impacts of climate change, using climate patterns and evidence, and regional and global projections; and
 - a phased and adaptive approach to action – focused on protection, elevation and consolidation as well as on the identification of knowledge gaps and capacity needs, and on the importance of innovative financing.
134. Understandably, much of RMI's adaptation efforts have focused on policies and measures to combat drought, which has already had a significant impact on communities. But focus over the coming years will also need to look more systematically at other aspects of adaptation, including the climate resilience of women, men and youth.
135. Particular immediate areas of focus for adaption are likely to be, but not necessarily limited to, coastal resilience including coastal vulnerability assessment.
136. RMI should set out a vision for adaptation and climate resilience, incorporating milestones to be achieved, for example by 2020, 2025, 2030 and 2050 – as well as suggested measures to achieve them. Prioritization will be critical to attract necessary private, public and international funding to implement policies, and in a way that is consistent with RMI's strategic interests.
137. Particular areas of focus for resilience could include, but not be limited to:
 - disaster risk management – including working through the Chief Secretary's Office to build further capacity nationally; and improving communications with outer islands;
 - contingency and emergency response – including putting in place a financial mechanism to allow rapid response and emergency funding, such as frameworks, protocols and procedures for rapid disbursement.
138. Thought will need to be given as to how progress against specific goals and milestones should be measured and tracked. Adaptation and climate resilience policies should be reviewed to identify overlaps and redundancies, with a view to consolidation. This review should also identify and clearly allocate responsibilities for taking forward specific policies.
139. A big barrier to implementing adaptation and resilience measures is long-term financing. Because private sector finance is particularly hard to secure in this area, public sector funding from the international donor/development sector must be a focus. In that context, capacity and resource constraints to RMI accessing some of major international climate finance and climate-related ODA is an issue that needs to be urgently addressed.

140. The cost and consequences of underestimating future changes, in particular future rates of sea level rise, and thus underinvesting in appropriate adaptation and building resilience would be catastrophic. Socioeconomic costs will also need to be evaluated, as well as the impacts of the identified responses to build adaptive capacity and resilience keeping in mind the women, men and youth of the most vulnerable communities. Therefore, RMI must apply the precautionary principle in future planning and implementation.
141. While RMI is already taking measures to adapt and to build resilience, including through a number of projects underway, including the Pacific Resilience Program Phase 2 (*PREP II*), the Addressing Climate Vulnerability in the Water Sector project (*ACWA*), and others, **it is now a matter of urgency to develop a NAP – and to aim to complete it by the end of 2019 at the latest.**
142. **RMI should follow up production of its NAP with a subsequent Adaptation Communication to the UNFCCC**, in which it sets out its contribution towards meeting the adaptation goal set out in the Paris Agreement (Article 2(1)(b)). The Adaptation Communication, and the goals it contains, should be based on the key recommendations of the NAP, preferably be quantifiable, and articulate the means of implementation needed to achieve those goals. The Adaptation Communication could be a stand-alone document or submitted as part of a subsequent National Communication. Building on the NAP, its production and submission need not be resource intensive.
143. **The commitment to produce a NAP and Adaptation Communication should be set out in RMI’s forthcoming NDC.**
144. The NAP should, as appropriate, align with and build on existing national and regional policies and plans, particularly the recommendations of the recently completed review of RMI’s JNAP (2018) and set out what RMI considers to be the most plausible scenarios for the key manifestations of climate change, in particular sea level rise, bearing in mind the need – consistent with the precautionary principle – to consider extreme-case scenarios.
145. While the NAP will need to articulate detailed priorities and actions for adaptation and building resilience, it is already clear that RMI’s pathway to adaptation will need to consider at least the following four areas:
- Protection: including coastal protection, infrastructure climate-proofing, community and household resilience building, food security, water security, health security, and broader adaptation and disaster risk reduction investments, including the development of financial mechanisms to finance investments and response and recovery efforts;
 - Elevation: all new construction of all types of structures should be elevated, based on the new National Building Code to be finalized in 2019 and other policies to be adopted. As conditions are likely to worsen, particularly sea level rise, new policies and plans for constructing elevated settlements for future consolidation of the population will be critical;
 - Consolidation: in the event that the majority of communities become increasingly vulnerable and experience more frequent and dire effects of

climate change, including flooding and inundation, there may need to be a policy to consolidate the population onto elevated settlements. It is plausible that a policy for consolidation may need to be considered sooner rather than later; and

- Relocation: while relocation should be considered the last-resort option, it is likely that some Marshallese will choose to migrate, as many have done so already. Moreover, it is possible that RMI may not be able to viably accommodate the entire 60,000-plus residents that are projected to be living in the country by 2030. Therefore, the Government will need to simultaneously assure the right of citizens to remain in the islands as best it can, and ensure continued opportunity for migration for those who so choose to relocate.
146. Given the dynamic nature of climate change and disaster risks, the NAP and Adaptation Communication should be reviewed and, if necessary, revised every five years as a minimum, aligning with the five-year cycles of future updates of this RMI 2050 Strategy.
 147. An immediate priority is securing financing for protection measures and to urgently address knowledge gaps in order to ensure a solid foundation for the milestones and measures to be set out in the NAP, including in the four areas set out above.
 148. More specifically there is an urgent need to expand coastal protection measures and investments, complete and implement the new building code, strengthen food and water security, and develop more formal financing mechanisms for both disaster risk reduction and post-disaster response and recovery. RMI must work effectively with existing and new development partners to secure initial resources for these priority investments.
 149. In relation to tackling critical knowledge gaps, some immediate critical questions that need to be addressed include:
 - How will global sea level rise translate into regional and RMI-specific sea level rise in the future?
 - What changes in precipitation, air temperature, ocean acidification, tropical cyclones, and coastal vulnerability and hazards will RMI likely experience in the coming decades?
 - What will be the economic, social, community, and health impacts of the increasingly adverse effects of climate change, including on the most vulnerable?
 - What resources, including sand and aggregate, are available – and what amounts are sustainable – for coastal protection and other adaptation and disaster risk reduction infrastructure projects?
 - How will sea level rise impact RMI’s claim to its sovereign territory, exclusive economic zone, and the resources within its current boundaries?

- How will marine resources such as pelagic (including tuna) and inshore species be affected by future climate change?
 - Can RMI construct elevated settlements to house its future population or a part thereof? How could such settlements be developed and settled?
 - If Marshallese relocate to other countries, what are the most appropriate places and means of resettlement? What rights and status would they have?
 - Should establishing resettlement communities be considered as an option to preserve the Marshallese language and culture?
150. RMI's future adaptation and resilience policies, including the NAP, should be underpinned by the following principles:
- our natural right to live on our islands – the Marshallese people have occupied this archipelago for some 3,000 years and have a natural and inalienable right to continue living and thriving in these islands. It is the RMI Government's official policy to assure this right to the women, men, youth and future generations of Marshallese, as well as to assure continued opportunity to migrate for those who choose this as their ultimate means of adaptation, to the best of its ability;
 - prioritize support and capacity building for the most vulnerable and those least capable of adapting – RMI's social protection system, which remains in an underdeveloped stage, will need to be strengthened to better deliver targeted social assistance and household and community support for women, men and youth;
 - a fundamental focus on resilience – building resilience to the effects of climate change as well as managing and mitigating disasters from natural hazard risks are strategic priorities for RMI;
 - follow best-practice – RMI will follow a best-practice adaptation and resilience approach, taking into account the latest scientific evidence, building on relevant lessons from other countries and regions, and working with development partners. A knowledge-first evidence-based approach will be critical, as will be taking into account indigenous knowledge and the knowledge of rural communities;
 - innovative financing, environmental, and engineering solutions; and
 - the exceptional circumstances of atoll nations like RMI – while climate change will surely impact all SIDS, the unique circumstances and unique vulnerability of atoll nations should be further recognized.

Potential Measures and Next Steps

151. Immediate priority next steps are to:

- take stock of and implement, as appropriate, the recommendations of the JNAP review; and
- initiate the production of RMI’s NAP, including securing external means of implementation to do so.

Local and Global Trends that will be Relevant to RMI’s Future Adaptation and Resilience Planning

152. The effects of climate change are manifest in changes in air and sea temperatures, rainfall patterns, ocean acidification, typhoons, and other observable phenomena. Figure 16 below summarizes the recent trends and future projections for these changes from the most recent sources available.

	Recent Trend	Projections
Air Temperature	Temperatures have increased. Annual maximum and minimum temperatures in both Majuro and Kwajalein have increased from the 1950s. In Majuro, maximum temperatures have increased at a rate of 0.22° F (0.12° C) per decade, consistent with the global pattern of warming.	Temperatures will continue to increase. Air temperatures are projected to continue to rise. By 2030, under a high emissions scenario, the increase in temperature is projected to be in the range of 0.8-1.8° F (0.4-1.0° C). This will result in more very hot days and warm nights, with a decline in cooler weather.
Rainfall and Droughts	Annual rainfall has decreased and droughts have become more severe. Rainfall data for Majuro and Kwajalein since the 1950s show a decreasing trend in annual and seasonal rainfall, significant at the 5% level. There has also been substantial variation in rainfall from year to year. The long-term negative trend suggests either a shift in the mean location of the Inter-Tropical Convergence Zone (ITCZ) or a change in the intensity of rainfall associated with the ITCZ. Dry seasons in recent years have been relatively more severe than in the past, with an extremely severe drought in 2015-2016 that prompted a State of Emergency.	Rainfall patterns will continue to change and droughts are likely to increase in frequency and duration. Most global climate models project an increase in average annual and seasonal rainfall through this century. While there is some uncertainty in the rainfall projections for RMI, increasing rainfall variability with potential for extended dry periods is expected. A recent analysis (UNDP 2018) confirms this, projecting higher rainfall but with longer and more intense dry periods and increased frequency and duration of droughts being very likely in RMI through 2045. The analysis shows that increases in drought frequency cannot be ruled out at the 95% confidence level.
Ocean Acidification	Sea level will continue to rise. Sea level will continue to rise in RMI, but the exact rate of increase depends on multiple factors. According to US NOAA (2017), the questions are <i>when</i> and <i>how much</i> , rather than <i>if</i> , and even if society sharply reduces emissions in the coming decades, sea level will most likely continue to rise for centuries. NOAA (2017) projects global mean sea level to rise by 2030 from a low scenario of 3.5 inches (0.9 meters) to an extreme scenario of 9.4 inches (0.24 meters). Sea level rise has not been uniform across the globe, and the Western Pacific region—which includes RMI—is expected to see increases of 20% to 40% above the global mean.	Ocean acidification will continue. By all indications, the acidity level of sea water surrounding RMI will continue to increase over this century, with the impact compounded by other stressors such as coral bleaching, storm damage, and fishing pressure.
Sea Level Rise	Sea level has risen. As ocean water warms, it expands and causes the sea level to rise. The melting of glaciers and ice sheets also contribute to sea level rise. Satellite data indicate	Sea level will continue to rise. Sea level will continue to rise in RMI, but the exact rate of increase depends on

	that sea level near RMI has risen by about 0.3 inches (7 mm) per year since 1993 — at this rate, the sea level has risen by 7 to 8 inches from 1993 to 2018. This is larger than the global average of 0.11-0.14 inches (2.8-3.6 mm) per year. This higher rate may be partly due to natural fluctuations or by the El Nino Southern Oscillation.	multiple factors. According to US NOAA (2017), the questions are <i>when</i> and <i>how much</i> , rather than <i>if</i> , and even if society sharply reduces emissions in the coming decades, sea level will most likely continue to rise for centuries. NOAA (2017) projects global mean sea level to rise by 2030 from a low scenario of 3.5 inches (0.9 meters) to an extreme scenario of 9.4 inches (0.24 meters). Sea level rise has not been uniform across the globe, and the Western Pacific region — which includes RMI — is expected to see increases of 20% to 40% above the global mean.
Flooding Events	Flooding and inundation events have increased. The frequency of annual flooding and inundation events has increased, with higher number of events observed in recent years in Majuro, Kwajalein, and other atolls. These typically occur during very high tides, including during King Tides, and/or during periods with strong ocean or wind-driven waves. A 2018 NOAA study reported that high tide flood frequencies on Kwajalein have grown to more than 5 days a year on average, compared to fewer than 1 day a year in 2000. The same general trend has been observed in Majuro.	Flooding and inundation to intensify. The frequency of inundation events will continue to rise, resulting in high tide levels increasingly exceeding what may be presently considered King Tide levels. Continued sea level rise and wave-driven flooding are expected to have a compounding effect, resulting in more frequent and increasingly severe flooding and damage. A 2018 study on Roi-Namur in Kwajalein projects sea level rise will exacerbate wave-driven flooding within just two to three decades. This will severely affect groundwater resources, critical infrastructure, and render everyday life more and more difficult in RMI.
Tropical Cyclones	Tropical cyclones frequency increased through the 1990s, but the recent trend is unclear. Historical records on major tropical storms suggest that from the 1970s through 1990s the frequency of reported storms affecting RMI (of all intensities) increased from 5 in the 1970s, to 7 in the 1980s, to 11 in the 1990s. In the recent two decades, the pattern has been less discernible, but RMI has seen fairly severe events in recent years, including from tropical storm Nangka in 2015.	Frequency projections for tropical cyclones uncertain, but intensity likely to increase. Projections indicate a decrease in the number of typhoons worldwide by the end of this century, but a likely increase in the average maximum wind speed and rainfall intensity of future typhoons. A recent study (UNDP 2018) projects the climatological baseline number of storms per decade in the RMI region as approximately 30; the multi-model mean projection is an additional 2 tropical storms per decade by 2035 and an additional 3 per decade by 2045. Power dissipation index is also projected to increase by 9% and 14% by 2035 and 2045, respectively— although these projected changes have medium confidence due to lack of statistical significance.

Figure 16: Climate Trends and Projections for RMI

Sources: Pacific Climate Change Science Program. 2011. Current and Future Climate of the Marshall Islands. RMI National Weather Service, Australian Bureau of Meteorology, and Commonwealth Scientific and Industrial Research Organization; US National Oceanic and Atmospheric Administration. 2017. Global and Regional Sea Level Rise Scenarios for the United States. US NOAA, USGS, US EPA, Rutgers University; Government of RMI and Secretariat of the Pacific Regional Environment Program. 2016. RMI State of the Environment Report. RMI, SPREP, ACP EU, and UNEP; Government of RMI. 2017. Post Disaster Needs Assessment of the 2015-2016 Drought. Majuro; US National Oceanic and Atmospheric Administration. 2018. Patterns and Projections of High Tide Flooding Along the US Coastline Using a Common Impact Threshold. Maryland; Storlazzi, Curt. et al. 2018. Most atolls will be uninhabitable by the mid-21st century because of sea-level rise exacerbating wave-driven flooding. Science Advances research article, April 2018; United Nations Development Program. 2018. Report on Climate Change Projections for the RMI. Annex 22, Feasibility Study, Green Climate Fund Funding Proposal, RMI Addressing Climate Vulnerability in the Water Sector Project.

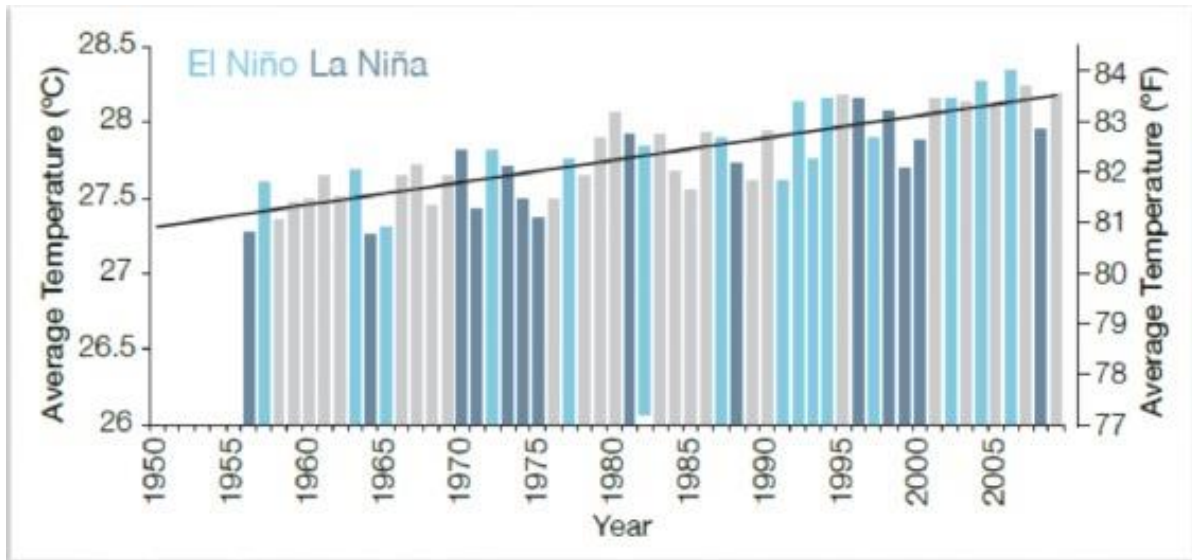


Figure 17: Annual Average Temperature for Majuro

Note: Light blue bars = El Niño years; dark blue bars = La Niña years; gray bars = neutral years

Source: Pacific Climate Change Science Program; RMI National Weather Service, Australian Bureau of Meteorology, and Commonwealth Scientific and Industrial Research Organization.

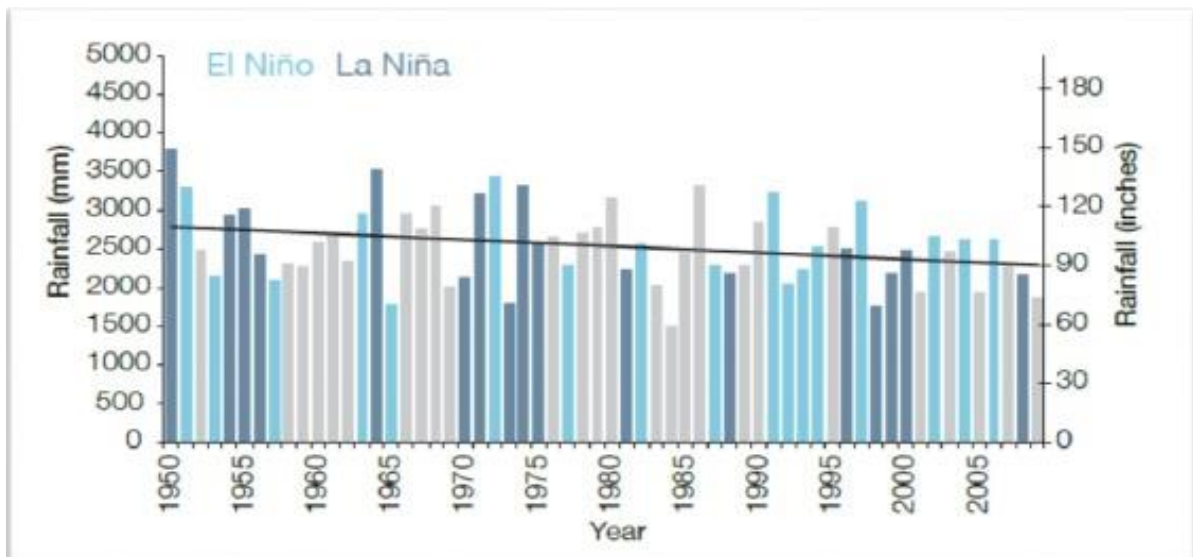


Figure 18: Annual Rainfall for Majuro

Note: Light blue bars = El Niño years; dark blue bars = La Niña years; gray bars = neutral years. The negative trend is statistically significant at the 5% level.

Source: Pacific Climate Change Science Program; RMI National Weather Service, Australian Bureau of Meteorology, and Commonwealth Scientific and Industrial Research Organization.

153. The most recent global mean sea level rise projections suggest a direr outlook. As reported by the National Oceanic and Atmospheric Administration (**NOAA** 2017), there has been continued and growing evidence that Antarctica and Greenland are losing mass at an accelerated rate; this growing evidence of accelerated ice loss only strengthens the argument for considering worst-case scenarios in coastal risk management.
154. Importantly, sea levels have not risen uniformly across the globe, and the anticipated level of sea level rise in the Western Pacific is between 20% to 40% above the global mean. This suggests that by 2030, in the best-case scenario RMI may experience 4.61 inches of sea level rise, and in the worst-case scenario over 1 foot (12.28 inches) of sea level rise.

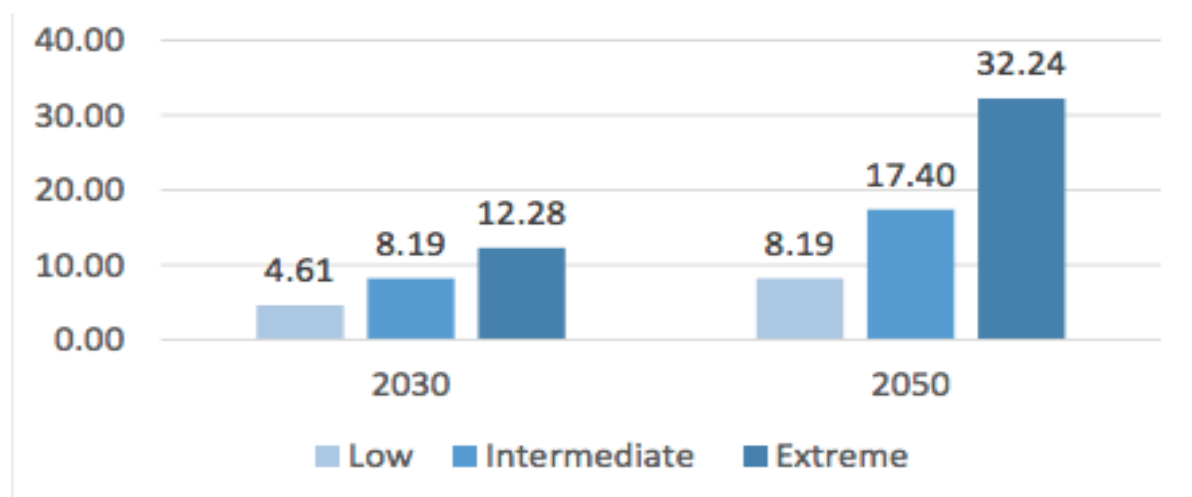


Figure 19: Western Pacific Mean Sea Level Rise Scenario Heights (inches): 2030 to 2100

Note: Figures are anchored on year 2000 and are for 19-year averages centered on decade through 2100. Only median values are shown. 30% additional sea level rise calculated based on global mean sea level projections.

Source: Calculations based on data from: US National Oceanic and Atmospheric Administration. 2017. Global and Regional Sea Level Rise Scenarios for the United States. US NOAA, USGS, US EPA, Rutgers University.

Section 4 – Means of Implementation

Headline Recommendations

- **Identify & consider** options for a more coordinated and centralized approach to applying for, and monitoring, overseas aid and investment in relation to implementation of RMI’s NDC and 2050 Strategy;
- **Develop** a long-term finance strategy to implement RMI’s current and future NDC, future National Adaptation Plan as well as this 2050 Strategy. The long-term finance strategy should:
 - prioritize and target funding applications in a strategic and coordinated way; and
 - be regularly reviewed and monitored to deliver against key objectives.
- **Prioritize** in-country capacity building and institutional strengthening in relation to every aspect of the implementation of this 2050 Strategy, and at all levels of stakeholders, including communities, women, men and youth.

Summary

155. Effective implementation of this 2050 Strategy will require coordinated efforts across all sectors, including governance, GHG emissions reductions, adaptation and resilience, finance, and monitoring, reporting and verification. The availability of means of implementation – including long-term finance and capacity building – will be major factors limiting the extent to which this 2050 Strategy can be implemented. RMI should maximize inward investment and provision of means of implementation on climate change-related issues. Continued political leadership at the highest levels, along with a clear governance structure for implementation of all aspects of this 2050 Strategy, will also be necessary.
156. There is no centralized comprehensive overview of the donor assistance/development aid that RMI is eligible to apply for, has applied for or has secured, nor of monitoring of implementation once funds have been secured in areas of relevance to the implementation of RMI’S NDC or this 2050 Strategy. A major cause is that responsibilities for doing so are fragmented across Government departments and agencies.
157. In order to improve efficiencies, to provide an enhanced enabling environment for donors and so attract more inward investment, and to secure funds consistent with nationally driven priorities, options for a more coordinated and centralized approach to applying for, and monitoring, overseas aid and investment in relation

to areas of relevance to RMI's NDC and this 2050 Strategy should be identified and assessed.

158. The main functions to be considered are:
- overall policy and priority setting – what funds to apply for, etc;
 - operational – such as oversight and quality control of applications, and ensuring alignment with high level Government policies, including this 2050 Strategy; and
 - monitoring – collection of data, including on project delivery.
159. In 2017 the Cabinet agreed in principle that the Economic Policy, Planning and Strategy Office (**EPSO**) should do overarching monitoring, and that the Division of International Development Assistance (**DIDA**) should centrally coordinate and manage overseas assistance, but a final decision has not yet been made. Any centralization of functions needs to be sensitively handled and not interfere with existing policy setting and substantive functions of existing Government ministries and departments, without careful consideration. In that context, consideration should be given to the Chief Secretary's Office having a role in relation to overall policy setting and prioritization.
160. In order to more effectively attract investment in relation to RMI's NDC, its future NAP and this 2050 Strategy **a long-term climate finance strategy needs to be put in place**. The long-term finance strategy should prioritize and target funding applications in a strategic and coordinated way. Consideration should also be given as to whether and how donor assistance could be pooled, so as to ensure efficiency and reduce administrative burdens on both donors and RMI. That long-term finance strategy should also be regularly reviewed and monitored to deliver against key objectives.
161. Unless more effective oversight and coordination is put in place, including establishing a clear mechanism to enable and improve the efficiency of Overseas Development Assistance (**ODA**) coordination, RMI's ability to attract necessary levels of future climate finance consistent with domestic priorities is likely to be significantly constrained. As such it is recommended that the Government urgently considers how to deliver a **more coordinated and centralized approach to applying for and monitoring overseas aid and investment**.
162. It is important that means of implementation build on and strengthen wider development policy across all sectors. Mitigation, adaptation, and climate change resilience actions identified in this 2050 Strategy should be further mainstreamed and integrated into existing development planning processes and national plans and strategies. Developing a new and separate process is not necessary.
163. RMI's strategic approach to long-term finance and wider means of implementation should be dynamic, and be periodically reviewed, assessed against delivery of objectives and updated to reflect and ensure relevancy, validity, transparency, and accuracy.
164. At the same time, means of implementation for short term action in line with the priorities of this 2050 Strategy is also critical. Implementation of RMI's NDC

Partnership Plan, which identifies the immediate priorities for action and existing gaps, and coordinates support from partners to achieve these priorities, will be very important. This can and should be leveraged over time to enhance donor support toward implementation of future NDCs and this 2050 Strategy.

165. In general, capacity and resource constraints are a significant factor restricting RMI’s ability to access international climate-related assistance. This is an issue that needs to be urgently addressed and in-country capacity building and institutional strengthening should be prioritized in relation to all aspects of implementation of this 2050 Strategy.

Potential Measures and Next Steps

Area	Activity
Long-term Climate Finance	<ul style="list-style-type: none"> • Review the climate finance landscape; • Establish institutional arrangements for the oversight and coordination of climate finance activities; • Compile an overall costing for the NDC; • Identify funding gaps and needs; • Assess public and private financing options and develop a country climate investment plan; • Develop a country climate investment plan; • Develop a project pipeline and financing propositions that can be put forward to different financing sources; • Increase private sector engagement and overcome barriers to investment; • Design and implement a climate finance MRV system.

Figure 20: Means of implementation potential measures and next steps

166. The Government should utilize a robust process in implementing this 2050 Strategy including an initial assessment of resource needs and clear sequencing of activities in accordance with identified priorities.
167. In that context a long-term climate finance strategy and strategy on wider means of implementation should clearly set out actions, timings, and responsibilities.

Section 5 – Transparency, Environmental & Social Information

Headline Recommendations

- **Review** roles and responsibilities for data measurement, reporting and verification (**MRV**), and **develop** policies to ensure that the current system is more effective;
- **Improve** capacity in the area of environmental information and social data collection, monitoring, reporting and verification as a priority, including through accessing available assistance such as the UNFCCC Capacity Building Initiative on Transparency (**CBIT**);
- **Prioritize** producing and submitting a Biennial Update Report and a Third National Communication; and
- **Transition** to using the latest IPCC Guidelines – including in the production of the next NDC.

Summary

168. Good quality data and monitoring systems are crucial for informed policy development and to measure progress towards achieving goals.
169. **The lack of reliable up-to-date quality environmental data is a significant issue in relation to every aspect of RMI's NDC and this 2050 Strategy.** Unless addressed, this will be a significant barrier to RMI achieving its climate change objectives as set out in its NDC and this 2050 Strategy.
170. The main problems are:
- institutional – fragmented, overlapping and unclearly allocated responsibilities for data collection and monitoring;
 - ineffective data coordination and sharing between Government agencies;
 - lack of resources and capacity.
171. RMI should review roles and responsibilities and should put in place policies to address these problems and to implement a more effective system. International means of implementation available to make improvements in this area should be accessed as a priority.
172. It should be noted that some of the analysis and recommendations in this 2050 Strategy are based on RMI's 2010 inventory as set out in its Second National Communication. That inventory should be officially updated and set out in RMI's

future Third National Communication. Once that is done, the recommendations in this 2050 Strategy may need to be updated in future revisions.

Potential Measures and Next Steps

Area	Activity
<p>Transparency, Environmental & Social Information</p>	<ul style="list-style-type: none"> • Access international means of implementation available to improve domestic MRV systems; • Review current MRV activities; • Establish institutional arrangements for the oversight and coordination of MRV activities; • Assess data gaps and needs; • Design and implement improved domestic MRV system for mitigation, adaptation and finance; • Establish data management processes; • Build MRV capacity; • Seek to improve the MRV system over time; • Identify international support available to assist RMI to begin preparing a BUR and its third National Communication.

Figure 21: Transparency, environmental and social information potential measures and next steps

Section 6 – Gender & Human Rights

Headline Recommendations

- **Mainstream and safeguard** gender and human rights, including in relation to developing, adopting, reviewing and implementing laws, policies and projects related to climate change;
- **Commission** further analysis with a view to implementing a strategy to improve disaggregated data collection, monitoring, evaluation and accountability;
- **Utilize** participatory community led, bottom-up approaches to identify challenges and best practices with stakeholders and beneficiaries;
- **Commission** specific research on impacts of climate change on men and women, and their associated responses, in all their diversities drawing on traditional knowledge and skills;
- **Secure** technical assistance and resources to strengthen capacity across national and local Governments, as well as civil society and NGO networks, to design and deliver gender-responsive climate change programs and services;
- **Ensure** programs and projects contribute to secure family wellbeing including healthy lives and livelihoods, through education, domestic partnerships, family and household responsibilities, sexual and reproductive health;
- **Eliminate** gender-based violence and increase protection and care of survivors;
- **Establish** an enabling environment for an equitable participation in, and benefits from, economic development;
- **Ensure** equitable participation of women and men in decision-making through equal opportunities for women and men in all fields of employment, inclusive decision-making and support women's entrepreneurship;
- **Design and implement** a program for progressive compliance with human rights obligations; and
- **Build** the knowledge and capacity of women, men and youth to address gender inequalities across sectors.

Summary

173. Climate change will affect everyone, but the impacts of climate change, and the response initiatives, will be differentiated among women, men and youth. Women and children, disabled and impoverished groups are often the most vulnerable and disproportionately affected by the impacts of climate change due to their marginalization in global society, limiting their access, use and control over resources and services. This limits their responses, including adaptive capacity and resilience to climate change.
174. The United Nations Framework Convention on Climate Change (**UNFCCC**) has put in place multiple mandates to support gender responsive and human rights-based approaches to ensure that climate change policy, programming and implementation address the interests, needs and capacities of women and men for efficient and effective outcomes. The recently adopted UNFCCC Gender Action Plan (**GAP**) states:
- 'Gender-responsive climate policy requires further strengthening in all activities concerning adaptation, mitigation and related means of implementation (finance, technology development and transfer, and capacity-building) as well as decision-making on the implementation of climate policies. The GAP recognizes the need for women to be represented in all aspects of the UNFCCC process and the need for gender mainstreaming through all relevant targets and goals in activities under the Convention as an important contribution to increasing their effectiveness'.²*
175. Additionally, the Sustainable Development Goals (**SDGs**) link gender equality (Goal 5) and climate change (Goal 13). SDG Target 13b suggests countries should:
- 'Promote mechanisms for raising capacity for effective climate change related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities'³.*
176. Natural disasters, climate change hazards, food insecurity, water crises and public health risks are all threats facing the women, men and youth of RMI. Climate risks are particularly serious, in part because sources of cash income are limited, leaving people with little in the way of savings or financial resources to adapt to changing conditions or recover from climate change-related stresses.
177. In 2016, studies revealed that the changing climate and environmental conditions associated with drought resulted in higher morbidity rates and declining nutrition levels, negatively affecting human development and quality of life. Drought also compromises food security with related malnutrition, notably in the outer islands. Natural disasters have resulted in an unknown number of internally displaced people, who have been forced to leave their homes and islands because of factors, including drought, exacerbated by climate change.
178. Women are more vulnerable than men to the effects of events related to climate change, but their critical role in recovery and resilience is gaining recognition. The

² <https://unfccc.int/topics/gender/workstreams/gender-action-plan>

³ <https://sustainabledevelopment.un.org/sdg13>

2015–2016 drought reduced women’s incomes from handcrafts because it decreased the supply of necessary materials (pandanus, coconut, vines, etc.) and, across RMI, increased the time and effort needed – and in some cases the cost – to secure water and to perform other household tasks for their families.

179. While women and different social groups have been disproportionately affected by the 2015–2016 drought, women’s contribution to the household economy is substantial. Therefore, women will be a critical partner in recovery and resilience. Post-disaster recovery resources must therefore strive to safeguard, restore and promote the economic engagement and participation of disadvantaged groups. Recovery efforts must redress gender inequalities or, at the very least, not perpetuate unequal access to power and resources.
 180. In early 2015, the RMI Government adopted its National Gender Mainstreaming Policy. The Policy guides the development of laws, policies, procedures and practices to address the needs, priorities and aspirations of all women and men and to eliminate all forms of discrimination and inequality. The priority areas of the policy are: strengthening capacity across Government to integrate gender equality into Government services and programs; family well-being and eliminating gender-based violence and protecting and caring for survivors; and improving women’s economic empowerment and participation in decision-making. The policy also identifies vulnerable groups of women including those living in the outer islands (rural areas) and those with disabilities.
 181. Going forward, key recommendations arising from the GAP should be incorporated, as appropriate, into existing and future RMI policies to implement this 2050 Strategy. Human rights obligations should be similarly mainstreamed and safeguarded.
 182. Reliable data in relation to gender issues is a major deficiency. A strategy needs to be put in place to address this, including identifying data needs. Sex disaggregated data needs to be collected to improve the monitoring of the impact and effectiveness of climate change initiatives and policies.
 183. Women, men, and youth should be included and engaged as valuable stakeholders in identifying and addressing the climate change concerns of their communities, and share knowledge for responses to ensure their strengthened resilience. Further support should also be commissioned from gender organizations in RMI, as well as gender and human rights experts in advocacy, engagement and capacity building, and for enhancing gender in sector-specific elements.
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Potential Measures and Next Steps

Issue	Suggested Next Steps
Gender equality and human rights are mainstreamed and safeguarded in RMI's existing and new climate and development policies, strategies, laws, and activities	<ul style="list-style-type: none"> • Conduct legislative review • Increase representation of women in national and local climate change decision-making and implementation • Increase representation of women in global decision-making processes and related events • Include references to gender and human rights in all Government documents related to climate change
Gender analysis is incorporated in strategic planning, programming, and implementation of climate change initiatives	<ul style="list-style-type: none"> • Gender analysis made mandatory • Conduct gender analysis for new and ongoing initiatives
Marshallese young women are empowered to respond to climate change and disasters, including through training programs rooted in traditional skills	<ul style="list-style-type: none"> • Training developed with traditional weaving as basis for understanding • Train young women in climate change and disaster risk management

Figure 22: Gender & human rights potential measures and next steps

Section 7 – Health

Headline Recommendations

- **Include** health considerations as part of RMI’s forthcoming National Adaptation Plan.

Summary

184. Climate change will exacerbate many current climate-sensitive health issues and threatens the ability of health institutions and organizations to maintain and improve health services into the future. This is expected to be particularly true in low-income countries and Small Island Developing States, who are especially vulnerable to the effects of climate change. In particular, climate change will disproportionately affect vulnerable groups, including the poor, children, elderly and those with pre-existing medical conditions.
185. The World Health Organization (*WHO*)⁴ predicts that the effects of climate change, including storms and flooding, rising sea levels, higher freshwater temperatures, reduced availability of food and drinking water, will translate into increased mortality and morbidity from extreme weather events and climate-sensitive diseases, such as malaria, dengue and cholera. The Paris Agreement specifically mentioned the right to health.
186. As such it is critical that RMI takes steps to increase the adaptive capacity and resilience of its health system. The most effective health adaptation strategies take into account that contextual factors as adaptation needs are often highly localized. RMI should undertake measures to identify and assess the greatest health risks and shortcomings in RMI’s current health system in order to develop effective strategies for minimizing the anticipated effects of climate change on health outcomes.
187. It is therefore recommended that health is clearly considered and included as part of RMI’s future NAP. As a starting point studies should be undertaken to develop a better understanding of climate-related health impacts in RMI, including on vulnerable groups.

⁴http://apps.who.int/iris/bitstream/handle/10665/176009/9789241564953_eng.pdf;jsessionid=9205E550AD8CAC3D30396D2A0AC66CAF?sequence=1

Potential Measures and Next Steps

Area	Activity
Health	<ul style="list-style-type: none"><li data-bbox="571 421 1370 472">• Relevant studies should be initiated to better identify potential health impacts from climate change in RMI and used inform the process of developing the NAP.

Figure 23: Health potential measures and next steps

Section 8 – Education, Training & Public Awareness

Headline Recommendations

- **Include** education, training & public awareness considerations as part of RMI’s forthcoming National Adaptation Plan.

Summary

188. The global community has recognized that education plays a key role in responding to climate change. The Paris Agreement specifically acknowledges the importance of “education, training, public awareness, public participation and public access to information” (Article 12) in the fight against climate change.
189. UNESCO⁵ has developed the following five recommendations for policy-makers on how climate change education (**CCE**) and education for sustainable development (**ESD**) can be integrated at the national level:
- Policy development: ESD is an interdisciplinary, cross-sectoral approach, which aims to prepare people for change by equipping them with a broad base of knowledge, skills, dispositions and values. Governments need to integrate ESD and CCE into all levels and types of education and across the curriculum.
 - Governance and resources: Integrating CCE and ESD into national systems requires high-level support from the Government, with cross-sectoral coordination and harmonization. CCE and ESD programs were found to be more successful when a national coordination structure was clearly defined.
 - Curriculum development: Ministries of Education and education planners should review, develop and strengthen their curricula to ensure that CCE and ESD feature at all levels of the education system. This will entail creating new work units for teachers, and developing new pedagogical approaches with greater emphasis on critical thinking and problem-solving skills. New curricula should be flexible enough to be adaptable to local contexts.
 - Capacity-building of teachers and education planners: Teachers and non-teaching staff need to understand climate change, and have sufficient, locally-adapted materials for classroom use.
 - Public awareness, communication and stakeholder involvement: Governments should support non-formal education opportunities provided

⁵ <http://unesdoc.unesco.org/images/0023/002330/233083e.pdf>

by communities, civil society and the media, all of which play an important role in conveying information about climate change mitigation and adaptation.

190. It is recommended that education considerations in the broadest sense are clearly considered and included as part of RMI’s future NAP. As a starting point studies should be undertaken to develop a better understanding of climate-related education issues and needs in RMI, including among vulnerable groups.

Potential Measures and Next Steps

Area	Activity
Education, Training & Public Awareness	<ul style="list-style-type: none"><li data-bbox="571 819 1294 875">• Relevant studies should be initiated to better understand the specific climate education needs in RMI and to inform the process of developing the NAP.

Figure 24: Health potential measures and next steps

Section 9 – Approach & Future Perspectives

Headline Recommendations

- **Review and update**, as necessary, this 2050 Strategy as a minimum every five years – including to recommend targets for inclusion in future NDCs – at least one year before RMI submits future NDCs pursuant to the Paris Agreement;
- **Collect comments** on this first 2050 Strategy from stakeholders – including Government, private sector, donors, members of the public – and use them to inform implementation and subsequent updates;
- **Design and implement** a domestic process to oversee future reviews and revisions of this 2050 Strategy and to monitor its implementation. The TTE Committee (or another body) should have a future role in:
 - monitoring the alignment and consistency of relevant legislation, policies and measures with the 2050 Strategy;
 - overseeing the update of the 2050 Strategy every five years – including the goals it contains;
 - monitoring progress towards achievement of RMI’s NDC; and
 - recommending the targets and goals of future RMI NDCs.
- **Ensure** due diligence is fulfilled before making significant investments to implement this 2050 Strategy, including, as appropriate, peer review, third party review and an open and transparent procurement process.

A Dynamic 2050 Strategy

191. In producing this 2050 Strategy, a strong feeling prevailed among stakeholders that existing RMI legislation, measures and policies should be built upon and inefficient duplication and replication should be avoided.
192. At the same time, this 2050 Strategy should serve as a useful tool in setting the context for, and influencing, relevant near, medium and long-term planning and decision-making at all levels of stakeholders. As such, the purpose of this 2050 Strategy is to enable relevant RMI decision-makers to make well-informed decisions based on the full national context and not only on economic considerations.
193. The importance of this 2050 Strategy being treated as a dynamic document has been strongly emphasized by all categories of stakeholders, who were also of the view that it should be improved and refined over time.

194. A key recommendation is that in order to provide an effective context for policy making and planning **this 2050 Strategy is reviewed and updated, as necessary, as at least every five years**, including to identify and consider new and relevant technologies and policy options. More immediately, once the key outcomes and recommendations from the 2nd National Climate Dialogue and the Partnership Dialogue have been identified, they should be collected and used in the implementation and in future updates of this 2050 Strategy. Other comments received in future from stakeholders of all levels – including Government, private sector, donors, members of the public – should be similarly collected and used.
195. In that sense the 2050 Strategy should be treated as a **living document**. As such it will be critical that the key findings of this 2050 Strategy are disseminated and feedback sought.
196. Furthermore, updates to this 2050 Strategy should recommend the targets for future RMI NDCs one year in advance of the submission to the UNFCCC in line with the Paris Agreement. The updating process should include stakeholder consultation.
197. When implementing this 2050 Strategy, in particular when considering short-term measures, reference should also be made to RMI’s NDC Partnership Plan.
198. A domestic process should be put in place to oversee future reviews and revisions of this 2050 Strategy and to monitor its implementation. A critical role will be to ensure the five-year NDC updating process is undertaken in the context of RMI working to deliver on its long-term vision. This overarching function could be achieved through maintaining the TTE Committee or by another new or existing body. The TTE Committee (or another body) should have a future role in:
- monitoring the alignment and consistency of relevant legislation, policies and measures with the 2050 Strategy;
 - overseeing the update of the 2050 Strategy every five years – including the goals it contains;
 - monitoring progress towards achievement of RMI’s current NDC; and
 - recommending the targets and goals in future RMI NDCs.
199. Consideration should be given to setting out the status and function of the TTE Committee (or other body) in legislation, so as to give it independent standing, insulate this 2050 Strategy from political changes, and ensure its longevity. Models such as the United Kingdom *Climate Change Act 2008* and its Climate Change Committee⁶ should be considered if they offer useful precedents. In any event, the UK’s standing offer to provide technical advice and insights into the functioning of its *Climate Change Act* should be taken up.
200. As an immediate suggestion, the Environment Minister could usefully report once a year to the *Nitijela* on the state of implementation of the 2050 Strategy. This could be done annually, on the day after the opening of the *Nitijela* in August, and

⁶ <https://www.theccc.org.uk/tackling-climate-change/the-legal-landscape/the-climate-change-act/>

dedicated to the memory of Minister Mattlan Zackhras whose vision led to the production of this 2050 Strategy and who passed away in August of 2017.

Due Diligence

201. Decisions in the short term have the potential to lock RMI into a particular development pathway for many years to come. As such RMI should undertake full due diligence before making any significant investment decisions related to the implementation of this 2050 Strategy. Options could include, as appropriate, peer review, third party review and open and transparent procurement processes. This is of particular importance when deciding on technological options for implementation – there are examples of developing countries being sold outdated technologies, obsolete or even outlawed in developed countries (e.g. for failing to meet important environmental health standards).

Section 10 – Background to the RMI 2050 Strategy

Why Have a 2050 Strategy?

Benefits

202. The RMI Cabinet, as well as members of the TTE Committee, have identified several benefits to having a 2050 Strategy:

- A clear framework for RMI’s decision-making and to constantly anchor that in a wider vision. Most importantly this 2050 Strategy will set out a long-term context that will guard against short-term decision-making inconsistent with achieving net zero emissions, including those often driven by donors, partners and economic interests;
- Clarity for the Government and other stakeholders by holistically bringing key information, policy and financial requirements together in one place. In turn, this can help achieve better domestic coordination;
- Improved donor coordination. This 2050 Strategy will for the first time provide a hierarchy of climate-related needs – and hopefully a discipline – so that support can start to flow to where it is needed most, when it is needed most. In other words, financial and capacity support will for the first time be holistically aligned with our strategic national climate priorities;
- Delivery of benefits for Marshallese women, men and youth. By asking the fundamental question of what kind of country RMI wants to be by 2050, RMI will become less reactionary and more proactive in its policy process. Furthermore, by developing and implementing this 2050 Strategy through consultative processes with a wide range of stakeholders, the RMI Government can ensure that the population supports RMI’s climate change priorities, and has a role in setting those priorities. In turn this will help translate RMI’s international climate change leadership into tangible benefits for Marshallese people on the ground through sustainable, climate resilient development; and
- Maintaining RMI’s international climate leadership by walking the walk, not just talking the talk. By taking the steps to produce RMI’s own 2050 Strategy, RMI aims to press its international partners to do so as well, including by sharing lessons learned. In turn this will support the wider global commitment to limit temperature increase to well below 2°C, pursuing efforts to limit it to the 1.5 °C cap needed for the survival of RMI.

Commitments under the Paris Agreement

203. Having a 2050 Strategy also helps RMI deliver on its commitments under the Paris Agreement. As the Agreement states, Parties aim to “strengthen the global

response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by:

(a) Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;

(b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production; and

(c) Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development". (Article 2(1))

204. The Paris Agreement goes on to invite Parties to strive to formulate and communicate long-term low greenhouse gas emission development strategies (*2050 Strategies*) [...](Article 4(19)). In accordance with this, at the Conference of the Parties in Marrakesh (**COP22**), President Heine committed RMI to producing a 2050 Strategy⁷.

205. The preamble of the Paris Agreement states that:

"Parties should when taking action to address climate change, respect, promote and consider their respective obligations on human rights, the right to health, the rights of indigenous peoples, local communities, migrants, children, persons with disabilities and people in vulnerable situations and the right to development, as well as gender equality, empowerment of women and intergenerational equity".

⁷ <https://thecvf.org/cvf-2016-forum-press-release/>

The Process that Led to This 2050 Strategy

Timeline & Process for Producing the RMI's 2050 Strategy

206. Timeline and process:

- **21 August 2017** – skeleton outline of the Strategy discussed and agreed by the Committee;
- **22/23 August 2017** – RMI Cabinet endorses approach to developing 2050 Strategy;
- **19-20 July 2018** – 2nd National Climate Dialogue;
- **22-23 July 2018** – NDC Partnership Dialogue;
- **July/August 2018** – revised draft 2050 Strategy;
- **August 2018** – presented final draft of Strategy to Cabinet for approval;
- **Third quarter 2018** – published RMI's final 2050 Strategy.

The TTE Committee

207. The TTE Committee, comprising key stakeholders, was formed in order to oversee the production and implementation of RMI's 2050 Strategy. The Government energy planning division has served at the Secretariat to the Committee.

The 2nd RMI National Climate Dialogue Process & Partnership Dialogue

208. The 2nd National Climate Dialogue was held on 19-20 July 2018.

209. In order to support the delivery and implementation of the 2050 Strategy in the future, a Partnership Dialogue took place on 22-23 July 2018. The Partnership Dialogue engaged a range of key international stakeholders who will be crucial to the realization of the goals of the 2050 Strategy, including through the production of an NDC Partnership Plan.

210. As recommended above, the outcomes of the Dialogues, as well as the NDC Partnership Plan should be used to inform the implementation of this 2050 Strategy, as well as its future updates.

Section 11 – Methodologies, Baseline, Projections

11a – Greenhouse Gas Emissions

Methodology

211. Data was collected on a variety of inputs which were then used to separately calculate carbon dioxide (**CO₂**) emissions, methane (**CH₄**) emissions, and nitrous oxide (**N₂O**) emissions. Using the Intergovernmental Panel on Climate Change Fifth Assessment Report's (IPCC AR5) 100-year global warming potentials, CH₄ and N₂O emissions were converted to CO₂-equivalent emissions. These three emission sources were then summed to arrive at a total of CO₂-equivalent emissions. Using 2010 and 2015 data, current emissions were calculated based on fuel consumption multiplied by emissions factors. For these emission factors, EPA's 2015 estimates were used. Overall, the same approach was followed as used in Chapter Two of the RMI's Second National Communication (August 2015) regarding emissions that were, or were not, included using the improved data collected since this document was published. In some cases, the original IPCC GHG protocol equations were used to calculate emissions.
212. Data collected to produce this 2050 Strategy included: population data, burning and recycling rates, waste generation, copra production, fossil fuel consumption (kerosene, liquefied petroleum gas, diesel, gasoline, etc.), cooking demand, fuel efficiency, electricity system losses, electricity loads and consumption, levels of current renewables penetration, renewable resources and performance, number of vehicles driven, and vehicle miles per year.
213. In addition to the Second National Communication, another point of reference was the RMI's NDC, which projects emissions reductions in 2025 and 2030 from a baseline in 2010. This 2050 Strategy therefore also uses the baseline year of 2010. The Second National Communication notably does not account for emissions from the waste sector. In developing its NDC, RMI updated its emissions inventory to include the waste sector. However, data collection for this sector is poor and requires revision in the Third National Communication. Similarly, the Second National Communication disregarded incineration or burning emissions. More recent 2017 studies show that burning is prevalent in RMI, so this source of emissions was included in the emissions inventory used to develop the 2050 Strategy.
214. The 2010 baseline emissions estimate relies on an extrapolation of a bottom-up calculation that accounts for 80% of RMI's population. The revised estimate of 168,000 metric tons (**Mtons**) is aligned with estimates made by the RMI Electricity Roadmap and is in close agreement to the 170,000 Mtons estimate made in the Second National Communication.

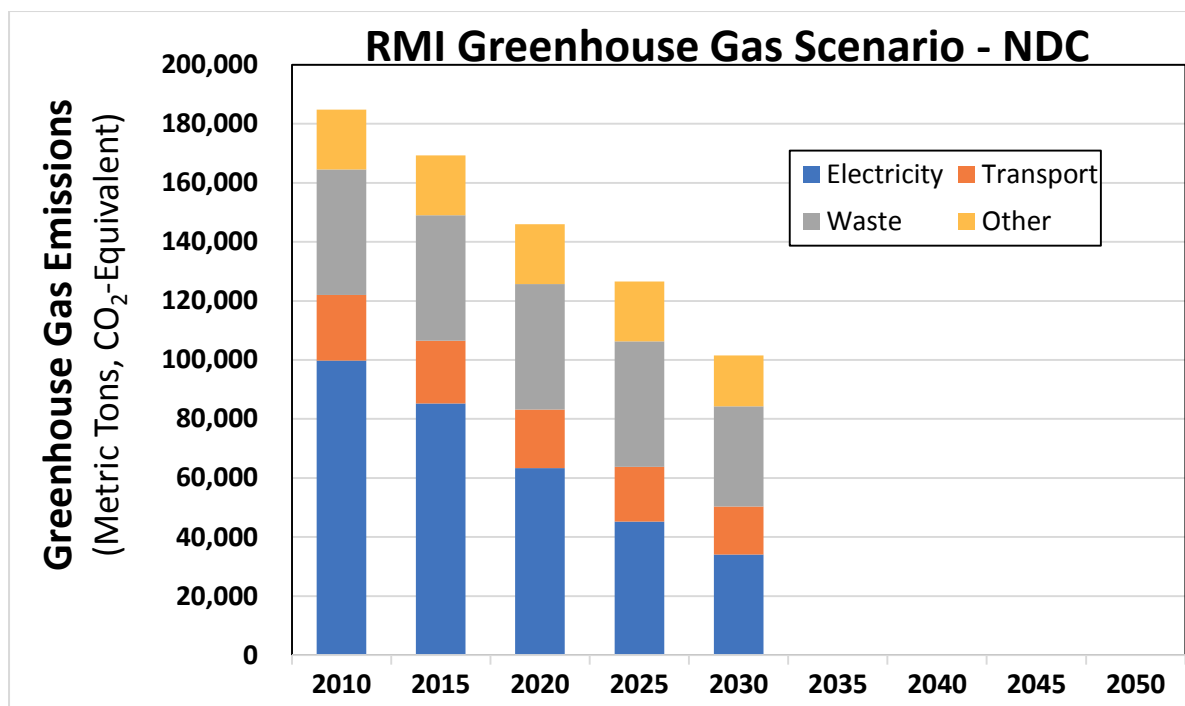


Figure 25: RMI's Greenhouse Gas Scenario – NDC

215. RMI produced its NDC in 2015. The key provisions of the NDC state that:
- RMI commits to a quantified economy-wide target to reduce its emissions of GHG to **32% below 2010 levels by 2025**;
 - RMI communicates, as an indicative target, its intention to reduce its emissions of GHGs to **45% below 2010 levels by 2030**;
 - These targets put RMI on a trajectory to nearly halve GHG emissions between 2010 and 2030, with a view to achieving **net zero GHG emissions by 2050**, or earlier if possible.
216. The NDC also contains sections in relation to adaptation and means of implementation.
217. Since RMI seeks to significantly reduce its emissions and explore pathways to zero emissions by 2050 goal, the Moderate Scenario is not a “business as usual” scenario, but rather assumes significant renewables penetration and efficiency improvements. The Lighthouse Scenario assumes maximal effort, implemented rapidly, whereas the Significant Scenario assumes the same actions as the Lighthouse Scenario delayed by 15 years due to presumed lack of funds.
218. The quantitative analysis and scenarios on which the 2050 Strategy is based is focused on Majuro and Ebeye because they are the main population centers and because relevant environmental data is most readily available in these cities. From this base, assumptions and recommendations can be extended to other parts of RMI.
219. The specifics of the choices and assumptions made in relation to the scenarios, pathways or measures set out in this 2050 Strategy may likely change in the

future, as technology improvements, costs, local preferences and market acceptance, as well as financial constraints, all change over time. As a next step, further feasibility studies and/or pilot projects are recommended in order to validate and verify that these pathways are feasible in RMI. On this basis, assumptions made should be modified and the model improved in the future.

11b – Adaptation, Environmental Information & Means of Implementation

220. The analysis underpinning the parts of this 2050 Strategy unrelated to GHG emissions reductions – including on adaptation, environmental information and means of implementation - was based on data collected through interviews with key RMI stakeholders as well as desktop reviews of relevant materials.

Section 12 – Acronyms

ACWA	Addressing Climate Vulnerability in the Water Sector Project	MCG	Millennium Consumption Goals
CAFE	Corporate Average Fuel Economy	MEC	Marshall Energy Company
CBIT	Capacity Building Initiative on Transparency	MRV	Measurement, Reporting and Verification
CESC	Clean Energy Solutions Center	MTC	Ministry of Transport and Communication
CH ₄	Methane	Mtons	Metric tons
CO ₂	Carbon Dioxide	MW	Megawatts
COP22	Conference of the Parties in Marrakesh	N ₂ O	Nitrous Oxide
CVF	Climate Vulnerable Forum	NAP	National Adaptation Plan
DIDA	Division of International Development Assistance	NDC	Nationally Determined Contribution
EPA	Environmental Protection Agency	NOAA	National Oceanic and Atmospheric Administration
EPD	Energy Planning Division	OEPPC	Office of Environmental Planning and Policy Coordination
EPSO	European Plant Science Organization	OTEC	Ocean Thermal Energy Conversion
EU	European Union	PPA	Power Purchase Agreement
GAP	Gender Action Plan	PREP II	Second Phase of the Pacific Resilience Project
GDP	Gross Domestic Product	RMI	Republic of the Marshall Islands
GHG	Greenhouse Gas	SCADA	Supervisory Control and Data Acquisition
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit	SIDS	Small Island Developing State
IMO	International Maritime Organization	SPREP	South Pacific Regional Environment Program
IPCC AR5	Intergovernmental Panel on Climate Change Fifth Assessment Report	UNDP	United Nations Development Program

IPCC	Intergovernmental Panel on Climate Change	UNFCCC	United Nations Framework Convention on Climate Change
IRENA	International Renewable Energy Agency	US	United States
JNAP	Joint National Action Plan on climate change adaptation and disaster risk management	USP	University of the South Pacific
KAJUR	Kwajalein Atoll Joint Utility Resources	VMT	Vehicle Miles Travelled
LPG	Liquefied Petroleum Gas	WTE	Waste-to-Energy
MAWC	Majuro Atoll Waste Company		

Section 13 – Acknowledgments

221. The Committee would like to acknowledge the help and contributions of the following to the production of this 2050 Strategy:

- All the members of the TTE Committee;
- Independent Diplomat;
- Meister Consultants Group, Clean Energy Solutions Center (**CESC**) who did much of the technical analysis and modeling underpinning this 2050 Strategy;
- The 2050 Pathways Platform;
- The NDC Partnership Support Unit.

